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INDUSTRY'S COMING OF AGE

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BY

REXFORD GUY TUGWELL

Co-author with Thomas Munro and Roy E. Stryker of "American Economic Life"

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INTRODUCTION

One who has been aware, through some curious chance, of the recent technological history of industry will find this study commonplace. It is because such an awareness is both unusual and important that *Industry's Coming of Age* has been written. Perhaps my own preoccupation with the problems of contemporary economic life gives them an exaggerated importance in my mind; but still one cannot avoid knowing, independently of this, that these are the problems which furnish the background, even the theme, of much of our American literature. No poet, novelist or essayist seems able to ignore them altogether, though many apparently would like to: the treatment of industry in our literature betrays resentment more often than acceptance, bewilderment more often than confidence or mastery. A certain cumulative complexity may account for this—together with some disastrous defects in our traditional education and in our economic writing. American education cannot be said to have succeeded conspicuously in making us at home in our world; and economists have not risen to the challenge of a civilization which needs an expertness of their sort.

Living as we do in a world alien to us, it is not surprising that we think mostly in one of two ways: either how to escape, or else how to express our bitterness. Literary folk can adjust themselves by distilling upon paper the essence of their discomfort; less vocal persons, with the same gnawing in their souls, suffer in a silence relieved only on occasion and inadequately. Somehow

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there must come a change. Twisting our hopes backward, sighing for past ages we imagine to have been more pleasant, or vainly straining forward toward the unrealities of Utopia—all this must be modified into a willingness to accept the clay of to-day as the material of a to-morrow which may be molded in our hands. If our world has become more complex than we like, if the challenges it offers are difficult ones, we must somehow find the resource in our race for their acceptance and the energy for their pursuit. The beginning of understanding and control are, I am convinced, to be found in description and analysis. The problems must appear concisely and clearly. Industry, for instance, must not remain hidden to intelligent eyes in a mist of technical procedures. It must reveal its essentials to the scrutiny of all who care to study it.

For many years I have believed, mostly on the evidence of common sense—for there were few quantitative evidences available to one whose technical equipment was that of a theorist—that we were advancing more or less rapidly in productivity. In odd moments I have speculated about its significance. But while progress remained something less than startling, no especial attention was paid to the phenomenon; and I, along with my contemporaries, neglected to probe for the materials of understanding. The teaching of economics in school and college went on, as it always had, almost completely ignoring the study of production, and continuing to concentrate largely on the conceptual statements of a theory inherited from the contributors to an old tradition. Value and distribution furnish problems still, but our study of them is conditioned by their formulation in the England of the mid-nineteenth century. Much of our study had been wasted upon a purely taxonomic discipline.

It had been forgotten that industrial revolutions are a function of technological advance. Economists had taken their eyes off industry; its persistent, thrusting power had gone unnoticed; and the new industrial revolution has come upon most of them, therefore, unaware. Such a change is apt to grow into an old institutional structure unwatched except by the professionally informed; and those who have an expert knowledge of industry are now more likely to be engineers than economists. When a profession becomes so stiffly traditionalized as the economics of the past few decades, nothing less than a revolution is required to shake its faith and teaching. It is unfortunate, too, that economics has been most backward in its educational efforts. Most school texts, strange as it may seem to any one who realizes that the industrial structure is being rebuilt under our eyes, have changed but little in thirty years. In the midst of revolution there has been a little island of peace. But we are paying for it even now: a generation has gone out of the educational system almost wholly ignorant of economic affairs. One who doubts the economists' and educators' responsibility for this may test the fact by picking up again the text he used in school or college and finding in it, if he can, something which will explain to him the modern factory, the system of our market exchanges, or the working life with its rhythms dominated by machine routine.

There have been two mitigating circumstances. In schools of business the realities of the functioning system have come gradually to be analyzed and taught to future business men; and some analysts of the price system have gone a long way toward undermining the authority of traditional economics. But orthodoxy, in spite of these developments, has maintained its hold. What is happen-

ing to industry on its technological side, has almost completely escaped the notice of those who might have found a place for it in theory or in educational programs. But it is precisely these technologies which have changed most. And they must be worked into the structure of our doctrine. A civilization which is inescapably industrialized must come to self-realization before it can hope to subject industry to its uses. There is no other way.

At once the most easily measurable and the most favorable result of changing technique can now be seen to be an immense gain in the power to produce goods, to raise the levels of living—a power thwarted by misunderstanding and lack of intelligent direction, but still yielding startling evidence of advance. To understand how this achievement can be furthered rather than hampered, it is first of all necessary to investigate its causes. The greater part of this study will be devoted to this. Afterward we shall return to the problem of discipline, of creating from adolescence, with its trials and terrors, a normal and healthy maturity. Adolescence, in spite of its vagaries, is what adulthood must grow from. We must not expect to change its nature and we must try not to pervert its meaning. In fact we shall find ourselves merely pointing out what is favorable and what is not, and asking for encouragement or repression as the case may be.

R. G. T.

Columbia University.

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INDUSTRY'S COMING OF AGE

CHAPTER I

PROGRESS IN PRODUCTIVITY

1. *The increase of productivity per man-hour in industry.*

For certain of the facts concerning the extent of our increased productivity—one large phase of industry's coming of age—we owe a debt of gratitude to the Bureau of Labor Statistics of our Department of Labor. Beginning in July, 1926, there began in the *Monthly Review of Labor Statistics* the publication of a series of articles, which, more than any other account which has been made available, bring home the striking conclusion that there is revolution in our midst.[1] From this source we shall learn only, however, that there has been an increase in the productivity *per man-hour*—which means, of course, the accomplishment of one man working one hour. For evidence of general increases in productivity we must turn to other sources. For it will be seen that the fact that some men, in some occupations, accomplish more in each hour of work, need not mean that all men produce a greater total of goods in, say, a year of American experience. And this is because men are not equally efficient and neither are groups of men. It happens in this case that greater product

[1] Those interested in the statistical procedure of Mr. Ewan Clague, the writer of the articles, and the difficulties which were met in the investigation, will find a complete exposition in the *Review*. We shall here refer only to his general results. Mr. Clague had the whole investigation in charge.

is achieved, as we shall see a little later; but not so great a product, perhaps, as would result if all occupations were as efficient as the best of them. This, indeed, is one of our problems—to bring the worst up to the standard of the best.

Perhaps a word of warning and explanation would better be inserted just here; when men are spoken of as efficient or inefficient, the workers involved are not really being discussed at all. There is probably no difference, or very little at most, in the various working groups involved. They are the same men. We shall have occasion to note this again and again; but it cannot be repeated too frequently that efficiency, or the lack of it, is the responsibility of managers, not of workers. The industrial revolution has completely denuded the worker of responsibility, just as, also, it has stolen away his skill. The general policy of workers' organizations can help or hinder the progress of industry; but the worker on the job can scarcely affect the issue. It is the machine and the way it is managed, the materials and forces, and the manner of their marshaling, which make the difference, in our day, between efficiency and the lack of it. This has been too little understood.

For whatever cause, the change in the manner of work has come, and we are now able to see the results it has so far had, as well as what sort of program is foreshadowed. By way of introduction, Mr. Clague's report has to say:

> There is taking place in the United States today a new industrial revolution which may far exceed in economic importance that older industrial revolution ushered in by the series of mechanical inventions which occurred in England in the last quarter of the eighteenth century, and which eventually transformed English industrial, political and social life. Many people

today are aware of the fact that great improvements in machinery, processes, management, and output are taking place; but, except for a few magazine articles from time to time, very little has been done to express this advance in productive efficiency in comprehensive terms. Some people have hesitated to accept as typical of industrial production as a whole the surprising figures of improved output in particular plants or establishments. And yet, even when we deal in mass figures, the facts stand out clearly and unmistakably. We are at the present time experiencing what is perhaps the most remarkable advance in productive efficiency in the history of the modern industrial system. In the automobile industry the output per man in 1925 was three times as great as it was in 1914, an almost incredible increase in productivity in an industry which had attained, even before 1914, a high state of efficiency.

The following table will serve to summarize the results of this exhaustive investigation. The base used was the year 1914; the figure which appears is the 1925 percentage of the index for 1914.

Steel works and rolling mills	153
Automobile manufacturing	310
Boot and shoe manufacturing	116.5
Paper and pulp making	125.7
Cement making	157.8
Leather working	128.2
Flour milling	139
Cane-sugar refining	127.3
Petroleum refining	177.3
Slaughtering and meat packing	110.7
Rubber tire making	311

This means that steel workers were producing 53 per cent more steel in the same number of man-hours in 1925 than they were producing in 1914; that cement makers averaged a 57 per cent larger product per hour worked, and so on throughout the list. We might add to this, what has developed since, that railroad labor produced 254 traffic units per man-hour in 1926 compared with 100

in 1890. Taken together these yield an impressive composite picture of increased individual effectiveness in production.

For the sake of completeness, also, it might be well to report that even in our most backward industry—agriculture—there have been really impressive gains in efficiency per person engaged in producing. We probably have doubled the output per man since the beginning of this century. And just as in the industries cited, the advances have been most rapid in the last decade, even the last few years. All the problems of agriculture will not be solved when this new efficiency movement has progressed further, any more than will the problems of any other industry; but many of them will. And it may be interesting to cite the illustration of the 88 farmers in Nebraska whose average yields for 1925 and 1926 were raised to 60½ bushels of corn per acre under the stimulus of ten-acre corn-growing contests. The ten-year average yield for that region was 33 bushels. Many similar illustrations might be cited to show that in agriculture, as in industry, productivity in certain instances is much greater than the average. Mr. Peter Lux of Shelbyville, Indiana, for instance, has maintained a nine-year average corn yield for his whole farm of 86 bushels per acre. In one year the yield rose to 104 bushels. And these results are far from uncommon. But compared with them the general average of yields is tragically low. At best, we can point to only a few instances in which the obvious possibilities have been attained. Agriculture is a backward art, if it is compared, as a whole, with manufacturing technique.

If we possessed no other evidence concerning manufacturing industries than is represented by the summary we have made it would be enough to justify Mr. Clague's

reference to "a new industrial revolution" even though what appears is only that each man produces more in each hour that he works. We shall turn to other evidence a little later which will show the general results of this heightened personal productivity. Before we do this, however, we may profitably pause over the results of a study by Ann Jamba into the productivity of a New England cotton mill.[1] The significance of this study is that it furnishes figures running back to 1850, showing a gradual increase of productivity down to 1919; and reveals an immense increase between 1919 and 1925.

MAN-HOUR PRODUCTION OF COTTON CLOTH IN A NEW ENGLAND COTTON MILL, SHOWING PERCENTAGE INCREASES, 1850 TO 1925

Item	1850	1876	1890	1910	1919	1925
Pounds produced per man-hour	1.21	2.28	3.20	3.18	3.84	{ 8.12-sheeting 4.36-flannel
Per cent of increase	....	88	40	....	21	{ 111-sheeting 14-flannel

This table does more than merely demonstrate a great increase in efficiency. It shows a difference between the two products manufactured in this mill which is highly significant. The making of sheeting, which registers the greatly increased efficiency, was done, during the last period, in a newly-built mill under the best conditions; the flannel-making remained in the old mill. The results speak for themselves and furnish a key to some explanations for our heightened productivity which will be sought later.

These summary tabulations of increased man-effectiveness in manufacturing represent a considerable and intri-

[1] *Monthly Labor Review*, xxiii, 701 (October, 1926).

cate investigation which is not described here but which is available to anyone who will look up the sources. For our purposes, the important point appears in the picture they present of a startling rise in our manifest power to produce goods. It appears not to be confined to any particular industry but to be common to many industries which make the ordinary goods of everyday use. It does seem to be more startling in some than in others however, a fact which we ought not to overlook when we come to a consideration of the theories which would account for it. The fact that automobiles are made with such great efficiency may mean that other industries, so far as they can, ought to find their patterns of organization there.[1]

Whatever other conclusions we may draw from them, we must admit an amazing advance in efficiency in a number of instances. We are even justified, perhaps, in going so far as to say that they show what is possible—practically possible, even easily possible—for industry as a whole. We ought to view this new change in industry as nearly as we can manage in the same way we view the so-called industrial revolution which occurred in late

[1] Industrialists have already been warned that there is a lesson here which they must learn. J. H. Van Deventer in *Industrial Management* for January, 1926, asks for a consideration of the special achievements of the automotive industry. He asks the heads of a number of motor companies to summarize causes and then offers the suggestion of his own that, "months of research have enabled us to segregate seven factors, which, working in combination, have been chiefly responsible for these results: (1) Standardization and quantity production, (2) mechanical handling (conveyors, etc.) and the resultant pace-making, (3) automatic production-machinery, (4) quality of factory supervision, (5) labor efficiency, (6) purchasing policies and methods, (7) sales policy of passing cost reductions to consumer." All these are interesting to us here as foreshadowing the discussion which will follow concerning these causes.

eighteenth century England. We can see now something of what happened then. There was an invention, then a period of years in which its effects began to be felt; then another, with a similar wait for effects, and so on. It was a good half-century before industry was remade in the new image. Inventions are, however, cumulative. One prepares the way for several subsequent ones, each of these, in turn, for several more—and so progress occurs at a rate of advance for which there are no mathematical symbols. But some of these inventions are more basic than others in the sense of engendering progeny—which again makes calculation or prediction difficult. From the manifest results in productivity to which we have already pointed, it seems a fair inference that along about the beginning of the twentieth century or a little before, some new inventions took place which were of a very basic sort—not necessarily inventions of machines, for processes and forms of organization are as important as machines in the total ensemble of industry. Indeed, from the fact that our increased productivity seems to extend to many different industries, we may infer that it was of the nature of processes rather than machines.

That what is demonstrated to be occurring in some sections of industries has not yet occurred in all industries should not be taken as proof that it never will. We ought rather to remember that changes are, after all, slow, and slow because of the time required for a new technique to permeate the whole structure of industry. Spring does not become summer in a day. The importance of the illustration of the cotton mill used above appears to be very great in this connection. We see that there was a great increase very early; then a slowing down; and suddenly the greatest one of all in much the shortest period

measured. But the great increase in efficiency was confined to the making of sheeting and did not extend to the making of flannel. How account for these differences? This much seems clear, at least: That a new factory was needed to achieve the new efficiency. Whatever the secret may be of the gains we have made, it seems that they cannot come into full effect without the scrapping of old plant and building anew. The new efficiency, then, waits on rebuilding. If one knows anything about old-established businesses he knows the reluctance to scrap and begin over; he knows also that as margins of profit fall, there are smaller and smaller funds to do it with. It is difficult to do more than pay market rates of wages and keep up dividends. Sometimes these cannot be met; and, if wages are sacrificed, there ensue the results to be seen in so many New England cities and towns just now: low-living standards and pervasive unrest. If dividends are sacrificed, capital cannot be attracted and the situation develops from something bad into something worse. It might be possible on this basis to explain, partly, why automobile-making seems to have advanced more rapidly than any other industry in efficiency. It was a new industry; and all its plants are new.

We see one cause, at least, for delay in the communication of new efficiencies from one industry or one business to another—unwillingness or inability to scrap plant and build anew. There are others we have not mentioned, but from this alone we can infer that the process is necessarily slow and jerky but also that it is certain. Sooner or later inefficiency strangles business. We may keep it alive temporarily with monopolies or even with subsidies —as by tariffs for protection,—but it must eventually die. But this is to anticipate: we shall discuss at some

length, later on, what seem the most likely causes of efficiency and what are the chief difficulties in its attainment. We shall now consider briefly evidences that there are not only individual instances of greater efficiency, but that productivity as a whole exhibits a rising curve.

2. *Increase in general productivity.*

If it is interesting to know from first-hand investigations such as produced the figures concerning productivity just quoted that we are making gains in individual efficiency, it is much more interesting to see the reflection of this in general figures. We know now that industries *can* be more efficient; but we also know that American industries actually *are* more efficient. The testimony to this effect is almost universal. It will be well to examine some of it.

The chief of the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce, Dr. Julius Klein, in a recent statement, commented upon the fact that our exports had grown greatly in recent years, showing, in fact, for the fiscal year 1925–26 the huge total of $2,572,000,000 and this was for manufactured or semimanufactured goods only. This was an increase of 160 per cent over the prewar average and 59 per cent over 1921–22. These goods—manufactured and semimanufactured—make up 47 per cent of our total exports from 1910 to 1914 and 60 per cent in 1925–26, a fact which, in itself, is of significance if one stops to think it over. "And," Dr. Klein adds, "finished manufactures show even a greater growth than partly manufactured goods." Evidently our manufacturing efficiency is finding for our goods an increased market abroad, not, probably, because they are better, but because we can make and sell them more cheaply. At any rate it is a solid fact, and one worth

remembering, that our exports have increased enormously and that their bulk is made up not of raw materials, but of manufactured goods—and with a rapid further swing in that direction apparently under way.

So unusually rapid a change in economic arrangements as is evidenced here has, of course, caused a good deal of comment. Secretary Hoover was speaking of this situation when he said in New York in March, 1926:

If we examine the reasons why we should have been almost unique among nations in foreign trade recovery, I believe we can justly claim that it has been due to certain distinctively American accomplishments, and that in these accomplishments lies the confidence for the future. Our expansion of foreign trade is a part of our domestic progress, both socially and economically. And in this progress I would first mention the accumulative value of the intensified education, both elementary and higher, which we have been dinning into the American youth over the last 35 years. In this time we have multiplied our students in institutions of higher learning by 400 per cent. Today we have more than all the rest of the world put together. We have trained technical personnel in every avenue of production and distribution upon a scale vastly larger than that possessed by any other nation. We have realized from this and many other causes a great advance in business organizations and a great adaptability to new ideas and to shifting demand.

Our work people have increased in education and skill. Above all, they are largely free from the economic fallacy that restriction of individual effort increases the number of jobs. Our national unions have long since declared against such theories. We are reaping the benefits of some 600 industrial research laboratories, mostly established in the last 10 years. They are ceaselessly searching for invention and for every economy in the use of materials and method. Under the pressure of high wages we have ruthlessly revised our industry with every new invention. Beyond this there is great and coöperative movement in American industry and commerce for cutting out waste in a thousand directions through improved business practice, through simplification of processes and methods. Furthermore, we have

had a great advantage, which we must not deny, in that by volume production, made possible through a great domestic market, we have been able by repetitive processes to apply or focus every advance into standard commodities of high quality and low cost of production.

The cumulation of these forces has increased our national efficiency to a degree which I hesitate to express statistically lest we appear to exaggerate. But I might observe that, by and large, while we have increased our population 16 or 17 per cent in a dozen years, we have swelled productivity of the Nation by something like 30 or 35 per cent. Our farms produce 13 per cent more with the same number of farmers as 12 years ago; our railways carry 22 per cent more traffic with about the same number of men. We have tamed the kilowatt into the friend of man. We have now domesticated some 68,000,000,000 kilowatt-hours annually where we used 23,000,000,000 12 years ago. They increase output and decrease sweat.

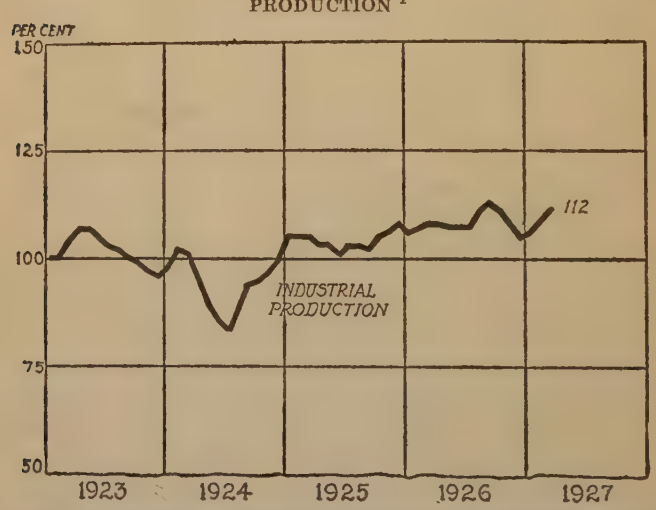
These are the reasons why we are able to sell goods of high quality, produced under the highest real wages in the world, in competition with goods produced under lower standards of living. These methods are not secret. They are open to the world. But they are rooted not alone in technology, which can be adopted by all intelligent people; they are rooted in social conceptions which penetrate far deeper and which not only promise greatly for the future in our standards of living at home, but, of more pertinent interest on this occasion, provide the basic assurance of our continuing growth in foreign trade, both exports and imports. These are the fundamental forces which promise for us our share of the world's increasing demands even of competitive goods—if we keep them in motion.[1]

Some of Mr. Hoover's remarks anticipate somewhat the examination of suggested causes which we shall make later, but his estimate of the increases in productivity is directly in point. And it does seem difficult to account for an increase of exports so great as this except on the

[1] Quoted in Dr. Klein's report. Consult *The United States Daily*, November 1, 1926.

basis of more efficient production. And since this is greater than the increase of our population, and since we have not lowered wages, it must be another evidence of increased productivity per man.

But we are not confined to inferential support for a theory of increased general productivity. There is plenty



Index Number of Production of Manufactures and Minerals Combined, Adjusted for Seasonal Variations (1923–25 average=100 per cent).

of a more direct sort. First there may be put in evidence a chart showing an index of physical production taken from the monthly publication of the Second Federal Reserve District:

This index runs back only to 1923 and so does not re-

[1] From the *Monthly Review of Credit and Business Conditions* of the Second Federal Reserve District, March 1, 1927.

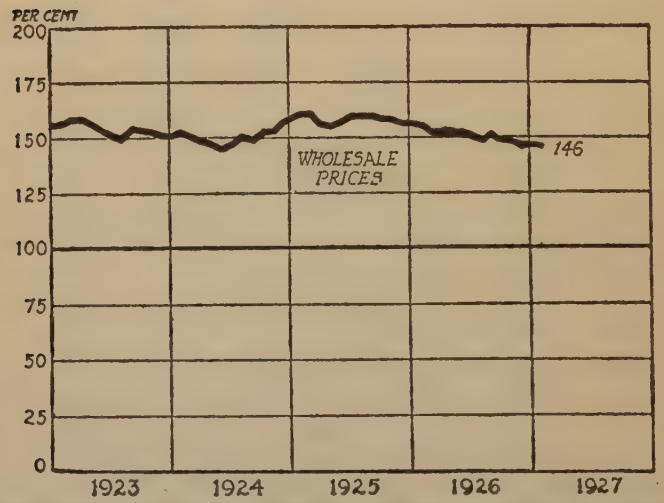
veal so great a contrast as it might if it were a comparison of prewar with postwar productivity. But it shows a level of production which at the lowest point in four years is above that of 1922 and which at most points is at least 25 per cent above 1922. It is significant, too, that during this period wholesale prices remained fairly stable, the index showing slight fluctuations mostly above 150 per cent of the 1913 level and with a general tendency downward.

The causes and significance of this gently falling price level are having a good deal of attention. According to orthodox theory, in a period of prosperity, prices should rise; but instead they have, in this period, fallen steadily. According to the generally accepted quantity theory, price levels are a function of volumes of money and volumes of exchange transactions (assuming that money circulates with a given rapidity). The secret of the present situation seems to lie in just these phenomena which are interesting us here. Greater productivity should bring prices down when currency is perfectly elastic. We have a fair approximation of elasticity; and we have a supply of credit which far exceeds the demand for it—as is shown by the high reserve ratio of the Federal Reserve system. Neither of these can be causing prices to fall. It would seem to be industrial efficiency. Higher living standards are achieved, of course, in this way. Lower prices with a sustained wage level must necessarily mean greater purchasing power.

There is another way of appreciating the significance of these slowly falling prices. Since the price decline has been very gradual, the money-income resulting from them must have been higher than for former years. An increase in income for the country as a whole is to be inferred.

It is clear that this income would, in general, be reflected in higher wages or salaries, and in dividends. Part of these wages and dividends would be saved and part would be spent. What was spent ought on the whole to make for a higher standard of living. What was saved would

WHOLESALE PRICES 1923–27 [1]



Wholesale Price Index of United States Bureau of Labor Statistics (1913 average=100 per cent).

be reflected in additions to capital equipment. It would be interesting to discover just what part of our total income is devoted to each of these two purposes. But statistics for this purpose are simply not at present available; furthermore, such an investigation would be somewhat aside from our main interest here.

Meantime, however, there is more evidence of increased

[1] *Ibid.*

WAGES, COST OF MATERIALS, AND VALUES IN MILLIONS OF DOLLARS; NUMBER OF ESTABLISHMENTS, WAGE EARNERS, AND HORSE POWER IN THOUSANDS

Period	*Number of Establishments*	*Wage Earners (Average Number)*	*Wages*	*Primary Horse Power*	*Cost of Materials*	*Value of Products*	*Value Added by Manufacture*	*General Wholesale Price Index, 1913=100*
1899	208	4,713	2,008	9,961	6,576	11,407	4,831	75
1904	216	5,468	2,610	13,296	8,500	14,794	6,294	86
1909	268	6,615	3,427	18,552	12,143	20,672	8,529	97
1914	177	6,896	4,068	22,291	14,278	23,988	9,710	98
1919	214	9,000	10,462	29,328	37,233	62,042	24,809	206
1921	196	6,947	8,202		25,321	43,653	18,332	146
1923	196	8,778	11,009	33,094	34,706	60,556	25,850	154
Increase 1914 to 1923:								
Amount	19	1,882	6,941	10,803	20,427	36,568	16,141	.....
Per cent	10.8	27.3	170.6	48.5	143.1	152.4	166.2	57.1

general productivity which ought to be noticed. The *Yearbook* of the Department of Commerce for 1925 devotes considerable attention to the matter as the most important industrial development in recent times. The year 1925 is notable as the highest point, hitherto attained, of industrial activity. Its output, according to the Department's index [1] was 11 per cent greater than that of 1924 and 5 per cent above the former peak year, 1923.

The specialists of the Department have also done something to make available an idea of our increased productivity throughout the period 1899–1925.[2]

The table on page 15 will repay close study. It not only furnishes data showing the details of progress, but also, for rough comparison of results, the general wholesale price index of the Department of Labor.

Indexes derived from the data in the table for the years 1919–1923 are shown graphically in the chart on the following page. Note particularly the gains since 1914, shown in the right-hand half of the chart; an impressive exhibit. In explanation the *Yearbook* says:

> The number of wage earners in 1923 represented an increase of 86 per cent over 1899, of 27.3 per cent over 1914, and of 26.4 per cent over the depressed year 1921, but a decline of 2.5 per cent from 1919, the peak of war activity. Every census compared shows a greater increase in wages paid than in number of wage earners. Between 1914 and 1923 the increase in average earnings per wage earner, 117 per cent, was much greater than that in the cost of living, the index for which had meantime risen about 65 per cent. The changes in manufacturing industry as between 1914 and 1923 are particularly significant. They

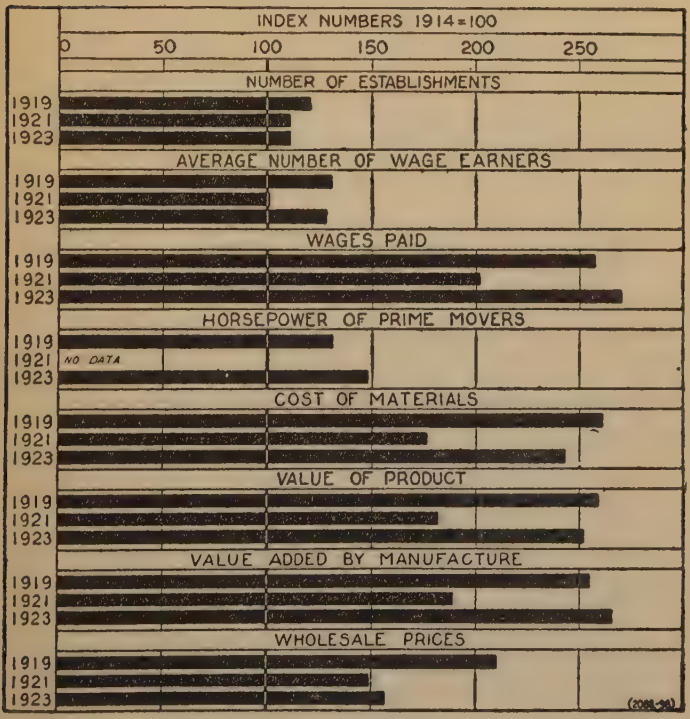
[1] This is a physical volume index covering 64 major industries. It may be inexact, but the margin of error ought not to be more than 5 per cent; the error, also, would not vary much from year to year in all likelihood.

[2] See pp. 13 ff. of the *Yearbook*.

may in some degree exaggerate the general progress, for the reason that 1914 was a year of more or less depression in certain

INDEXES OF CENSUS STATISTICS OF MANUFACTURING INDUSTRY [1]

—INDEXES OF CENSUS STATISTICS OF MANUFACTURING INDUSTRY



industries. With all possible qualifications, however, the fact that the value added by manufacture increased to 2.6 times as much in 1923 as in 1914 is highly significant.

[1] *Ibid.*, p. 14.

The increase in manufacturing industry from 1914 to 1923 becomes appreciably greater if the manufacture of distilled, malt, and vinous liquors, which has been reduced to a minimum by the prohibition amendment, is excluded. The principal items for these two censuses with the liquor industries omitted are as follows:

Item	*1914*	*1923*	*Per Cent of Increase*
Wage earners (average number)	6,826,000	8,777,000	28.6
Wages paid	$ 4,009,286,000	$11,007,300,000	174.5
Value of product	$23,322,973,000	$60,517,167,000	159.5
Value added by manufacture	$ 9,224,614,000	$25,832,198,000	180.0

It is possible to approximate only very roughly the quantitative change in the output of manufacturing industry as distinguished from that in value. One method is to select a large number of articles, the quantitative production of which is reported, to compute the percentage of change in each from census to census, and to combine these with proper weighting into a general average. This computation may fail to show adequately the increase in manufacturing industry for the reason that the non-standardized articles, not capable of quantitative expression or of comparison from census to census, have very likely increased more rapidly than the standardized articles. The calculation, however, is of much interest. The Census Bureau using this method has arrived at the conclusion that between 1914 and 1923 the production of standardized comparable articles by American factories increased 50 per cent. Similarly from 1919 to 1923 the output of such articles increased 19 per cent, although the number of wage earners was actually 2 per cent less in the latter year.

Another rough method of measuring the quantitative increase of output consists in the adjustment of the statistics of values to a uniform basis according to the changes in price levels as indicated by general price index numbers. This method may also understate the true increase in manufacturing output for

the reason that price indexes, like indexes of quantitative changes in production, are necessarily confined to the more standardized articles, and that it is probable that the less standardized articles advance less in price, where prices are rising, than the standardized. Such articles are largely newly-developed products in which improvements in methods and increase in output both tend to reduce cost of production. The Census Bureau has computed from the price statistics published by the Bureau of Labor Statistics an index of the average change in prices since 1914 for manufactured articles excluding raw foodstuffs and other raw materials. This index, with 1914 as 100, stood at 193 in 1919, and 156 in 1923. Applying these figures to the value of manufactured products reported by the census gives as the value in dollars of uniform buying power $23,988,000,000 in 1914, $32,213,000,000 in 1919, and $38,793,000,000 in 1923, showing an increase from 1914 to 1923 of 62 per cent, and from 1919 to 1923 of 20 per cent. These percentages of change correspond quite closely with those calculated by the other method above mentioned.[1]

[1] The *Yearbook* says in explanation:

The above figures of values at constant prices, like those of actual values, are gross, involving much duplication of output. If the relative amount of duplication had changed materially from one census to another, the method used would not give comparable figures of net quantitative output.

There is reason to believe, however, that it has not changed materially, and that the data given are fairly comparable. It is true that, apart from this duplication, the adjusted values given do not represent the actual contribution of the manufacturing industry, since they include the value (at constant prices) of raw materials. However, with the elimination of the effect of price fluctuations, in both materials and products, these calculated values do furnish a measure of the changes in the contribution of manufacturing industry, that contribution varying with the quantity of materials handled, as well as with the volume of service applied in transforming each unit of material into products of greater or less elaboration.

It is possible, also, to use price indexes to adjust from census to census the net item of value added by manufacture (that is, value of products less cost of all materials). However, this would not necessarily result in a correct measure of changes in the volume of service rendered by our factories, for this reason: The prices entering into

The changes in the efficiency of manufacturing industry may be roughly indicated by comparing the increase in quantity of output as above presented with that in the number of wage earners. The quantitative increase in product per wage earner may be due to greater efficiency of labor itself or to greater efficiency of employers and managers, or to greater use of machinery and other forms of capital, or to still other factors. Taking 60 per cent as the approximate increase in the quantity of output from 1914 to 1923, and with 27 per cent as the increase in the number of wage earners, this method indicates a gain of 26 per cent (160 divided by 127 equals 1.26) in production per wage earner employed. Most of this increase was between 1919 and 1923. The pressure for immediate expansion of production along certain special lines had tended to prevent much improvement in efficiency during the war. The quantitative increase of more than 20 per cent in output per wage earner between 1919 and 1923, only four years, was a remarkable achievement.

The Census Bureau has carried its calculations as to the quantitative growth of manufacturing production back as far as 1899. Between 1899 and 1923 the number of wage earners employed increased 86 per cent, the amount of horse power used 232 per cent, and the output (quantitatively) nearly 175 per cent. There was thus an increase of roughly 47 per cent in output per wage earner.

The manufactures census of 1925, the results of which are not yet available, will unquestionably show further quantitative increase in total production and in production per wage earner. This is clear from the indexes of production of major manufactured commodities already presented, and from the fact that the employment index of the Bureau of Labor shows no corresponding increase in the number of factory workers.

any price index are necessarily those of articles themselves, representing an aggregate value made up of value of materials and that added by manufacture. A change in the price of a given article may be owing chiefly to a change in the price of materials, or primarily to a change in the charge for services applied to the materials. Price indexes of manufactured goods may therefore not correctly reflect the variations in that part of price which represents payments for the contribution of manufacturing industry.

The evidence of increased productivity so far adduced brings us down through 1925, showing for the decade ending then about a 26 per cent increase. But for the first half of 1926 the rate was maintained. Secretary Hoover's report for the year ending June 30, 1926, which was issued in November, made this clear.[1] Following are tables which show this:

MAJOR ECONOMIC INDUSTRIES

(Based upon calendar year 1919 = 100)

Volume of Business (Quantities: not Value)	*Years Ended June 30*			
	1923	*1924*	*1925*	*1926*
Manufacturing production	116	115	118	126
Mineral production	119	133	129	132
Forest products production	117	122	121	124
Freight, railroad, ton-miles	109	110	110	120
Electric power production	186	148	158	179
Building contracts let, square feet	107	108	112	142
Value of sales:				
Department stores	118	125	126	133
Five-and-ten-cent stores	152	173	196	219
Mail-order houses	91	100	110	122
Wholesale trade	80	82	83	85

PRICE INDEXES

(Based upon calendar year 1913 = 100)

	Years Ended June 30			
Wholesale prices:	*1923*	*1924*	*1925*	*1926*
General average	156	150	155	156
Farm products	139	140	153	152
Food	142	143	153	156
Cloths and clothing	193	194	189	184
Fuel and lighting	220	175	169	175
Metals and metal products	139	141	130	128
Building materials	188	182	174	174
Chemicals and drugs	129	129	133	133
House-furnishing goods	181	178	171	166
Miscellaneous	122	116	124	134

[1] The report is presented in full in the *United States Daily*, November 29, 1926.

PRICE INDEXES—*Continued*

(Based upon calendar year 1913 = 100)

	Year Ended June 30			
Retail prices:	*1923*	*1924*	*1925*	*1926*
Food	143	146	150	162
General cost of living *	168	171	171	175

* Figures are average indexes for 3, 4 or 5 months distributed through the fiscal year, including in each case June of the previous year.

CONSTRUCTION STATISTICS

Indexes of Volume of Business (1919 = 100)	*Years Ended June 30*			
	1923	*1924*	*1925*	*1926*
Contracts awarded, value	135	143	164	205
Contracts awarded, volume in square feet of floor space	107	108	113	140
Cement shipments	152	158	178	183
Lumber production	117	121	120	125
Price indexes (1913 = 100):				
Frame-house materials, retail	198	206	198	195
Building-material prices, wholesale	188	182	174	174

3. *Increase in national income.*

It is a matter of elementary caution with economists to avoid confusion between the productivity of goods and the productivity of values. What matters to people who use them is how many and what kind of goods they have, not what their prices are. But almost all of them have to survive a pricing process; and they get into consumers' hands because the price is able to be paid. Prices cannot be ignored; but they must not be mistaken for goods. A good is the same good whether its price be high or low.

When, however, we talk of the money incomes of people we are talking about their power to possess goods—provided only we are cautious about the shifting value of money itself—because of the universality of pricing. When we say that the money income of the United States

has grown to nearly 90 billions in 1926, an increase of 27 billions since 1921 and 57 billions since 1914, we at once wonder how much of this increase is "real" and how much is to be attributed to advances in price levels. The National Bureau of Economic Research [1] answers this question by publishing a table in which current dollars and "1913 dollars" are represented side by side. By reading the column "1913 dollars" one is furnished a picture of actual increases in income.

CURRENT INCOME OF PEOPLE OF UNITED STATES

Year	*Current Dollars* (*Millions*)	*1913 Dollars* (*Millions*)
1909	27,100	28,200
1910	28,400	29,100
1911	29,000	29,300
1912	30,600	30,800
1913	32,000	32,000
1914	31,600	31,300
1915	32,700	32,000
1916	39,200	35,500
1917	48,500	37,300
1918	56,000	35,500
1919	67,254	37,600
1920	74,158	36,300
1921	62,736	36,200
1922	65,567 *	40,400 *
1923	76,769 *	46,900 *
1924	79,365 *	48,400 *
1925	86,461 *	51,100 *
1926	89,682 *	52,900 *

* Preliminary estimate.

In terms of comparable dollars, then, this period between 1914 and 1925—the period for which the figures for productivity in industry ran—shows an increase of from 31 billions to nearly 53 billions. Our great interest in this is

[1] In the *News-Bulletin*, February 21, 1927.

that it confirms other statistics concerning increases in our productivity. Perhaps also it is interesting to note the decided increase in annual increments in the period after 1914.

One other significant thing about these various statistics having to do (1) with man-hour productivity in representative occupations, (2) with the general physical volume of productivity for industry as a whole, and (3) for real income, is that they do not agree. They all disclose an amazing advance, but the differences are too great to be attributed to probable errors in any of the figures. The greatest advance is recorded for income, the lowest for general productivity. The fact that the great advances in some industries, such as cement-making and the manufacturing of automobiles and rubber tires, is not reflected in general productivity means simply that all industries have not been brought up to the standard of the best or that the great advances in certain industries were made before this period. This probably accounts for the bad showing, in these figures, of the meat-packing and shoe-manufacturing industries, for instance. But that income should have risen some 40 per cent while general productivity was increasing only 26 per cent furnishes a more difficult problem. Its solution is not central to our interest here but the suggestion may be ventured that shifts in consumption from low-priced to higher-priced goods may have something to do with it. As people's incomes rise, they may change decidedly toward higher standards which call for more expensive goods.

However this may be, there runs all through the evidence at hand, a compelling weight of authority on the side of increase in power to produce, and, in fact, on the side of increasing material welfare. The same bulletin

of the National Bureau of Economic Research may be quoted in support of this:

To many persons, figures showing the income per person gainfully occupied seem more significant than do those reporting income per capita. In the United States, in 1926, there were some 44,600,000 of the inhabitants who belong in the category designated by the Bureau of the Census as gainfully occupied—that is, they were engaged in activities yielding them direct money incomes. Some of these were employers, many more were employees, and some were simply working on their own account. The figures exclude housewives and women and children helping the head of the family on the home farm.

For every person gainfully occupied in 1926, there appears to have been an income of slightly over $2,000. When reduced to terms of 1913 purchasing power, we find that the average person working for a money income received about one-quarter more for his services than he obtained in 1917, and about 44 per cent more than he could have secured in 1909. The indications are, then, that despite the constantly growing population and the relatively inelastic nature of the supply of natural resources, new inventions and greater skill and organization are still enabling the average inhabitant to progress steadily upward on the scale of economic welfare.

This general result is disclosed in the following table:

INCOME PER PERSON GAINFULLY OCCUPIED

Year	*Current Dollars*	*1913 Dollars*	*Year*	*Current Dollars*	*1913 Dollars*
1909.....	791	823	1918.....	1,386	879
1910.....	809	829	1919.....	1,669	934
1911.....	812	821	1920.....	1,851	907
1912.....	844	850	1921.....	1,537	887
1913.....	864	864	1922.....	1,586 *	979 *
1914.....	836	828	1923.....	1,821 *	1,113 *
1915.....	861	843	1924.....	1,840 *	1,121 *
1916.....	1,014	919	1925.....	1,971 *	1,165 *
1917.....	1,232	947	1926.....	2,010 *	1,186 *

* Preliminary estimate.

What ought particularly to be emphasized in all this is that although we have made progress with a fair degree of rapidity ever since 1899, the acceleration since 1914 is almost of the nature of a new phenomenon. With all this data at our command, to say nothing of the evidence of observation open to anyone familiar with manufacturing and commerce, does it seem an exaggeration to say that we are in the midst of a new industrial revolution? One distrusts the word "revolution." It connotes overturn and rebeginning. What is happening is really not this. We are merely bringing to bear in industry a combination of common sense, inherited processes and inventions, and heightened human effort, such as never existed in any other time. It is of the utmost moment that all intelligent persons should concern themselves not only with the encouragement and furthering of this already clearly appearing trend but should assist in controlling its direction and results in the interest of human welfare.

In what we gather from the data at hand we are justified in feeling that almost unprecedented progress is being made. There is good reason for optimism. But it would be a mistake to leave the statement of the situation at this. One who studies the course of increased productivity, beside being impressed by a general increase, has also to acknowledge that apparently there are regressive forces at work which occasionally get the upper hand and interrupt the general movement. In 1921 and 1924, to name the most recent examples, we not only failed to make any general gains but we fell back seriously. Such a period of recession always sets us back a year or two and provides an interlude in which even the best efforts are wasted. This leads to the general conclusion that, although the increase in per-man-hour productivity forms a solid basis

in technology for advance, this need not necessarily always be registered in general gains in physical output, taking industry as a whole. In some year of the near future one of these disastrous recessions may set us back indefinitely. We shall have occasion to note this phenomenon, and to discuss its causes briefly when we come to an assessment of the causes of and the barriers to further progress.

Not only this, but also, if we study selective figures of physical output, we discover certain soft spots even in what, generally, are the best industrial years. Of late years one of these has been agriculture which, ever since the war, has, in the midst of prosperity, remained sunk in a trough of depression. Others during this same period have been coal mining and the textile trades generally. This suggests that there cannot be as great general advances as there might otherwise be, so long as some areas persistently lag behind. The cause may lie within the industry itself: a failure to advance in technique, for instance, or gross mismanagement; or it may lie outside; a change in consumption which reduces demand and leaves the industry without markets, or a failure of crops (in agriculture), or an unexpected shift of population. All these happen. They are difficult to predict, and force, sometimes, extensive readjustments—as when the manufacturing of cotton textiles moves into the South away from New England, or when water power is developed as a partial competitor of coal for making power.

The effect, however, is always serious. For such a depressed area has a tendency to spread. If cotton workers cannot buy automobiles or even food and clothing, the markets for those commodities are affected. And it is always a social burden, the costs of which must be borne by someone, to support industrial plants in idleness and

to have any considerable numbers of citizens existing under the conditions imposed by a depressed standard of living.

On the whole, though the main fact of progress stands out, there are not grounds for too great social optimism. Plenty remains to be done in a number of directions before our progress can be consolidated into a permanent new level of productivity insured by sound organization not only of local technique but of general arrangements for coördination and mutual assistance in troubled times.

CHAPTER II

SUGGESTED THEORIES TO ACCOUNT FOR OUR INCREASED PRODUCTIVITY

1. *Search for causes.*

The evidence just summarized seems sufficient to warrant some search for the causes of this major change in industrial affairs. There is nothing novel about such an inquiry. It has been attempted a number of times; and the proper way to begin a new effort is perhaps to review what has already been done, to examine the suggestions of causation which have been made by others. Some management experts have, themselves, offered what they called "principles" or "laws" of management. They had seen other sciences pass through the stages of classification, hypothesis, experiment, and the establishment of principles, and it seemed to them that the same course might be followed in a "science of management." Perhaps they are mistaken in trying to push as far as this the analogy between science and "scientific management." Management is rather an "industrial art" than an "industrial science." There are several reasons for saying this. First, none of the so-called "principles" has continued to be in operation for very long: each has been revised or modified out of all recognition in most cases. This would seem to indicate that management must be a mobile activity. The great difficulty the early engineers had in introducing their new processes came from the resistance of those who were incorrigibly addicted to "rule-of-

thumb" practices. Ways which are established and time-honored are apt to seem sufficiently good to the routinized mind. And it was because of this inertia rather than any active opposition (though there was plenty of that, too, from organized labor for about 20 years) that the first battles were lost. Since this is so, it would seem too bad to put management in chains again to a new set of laws or principles, which, although they are better adapted to present arrangements than the old rule-of-thumb methods, would in time become outworn. The persistency with which inferior minds cling to simple formulæ and too-general laws is astounding. This ought not to be encouraged by calling our generalizations from practice, which are really only temporary working rules, by the name "law," thus trying to give them the appearance of a permanency to which they have no valid claim. As a matter of fact, the term "scientific management," in the light of several decades of experience, seems much too pretentious a term. What is meant is really only freedom from preconception, not "scientific" in the strict sense, but depending on active and vigilant intelligence instead of rules-of-thumb.

Discounting then the attempt to give the engineers' statements the prestige attached to scientific law and thinking of them only as the generalizations of exceptionally well-informed and intelligent technicians, we may see what sort of classifications they have made of the new tendencies in management. In the late Frederick W. Taylor's *Principles of Scientific Management*, on page 69, four "underlying principles of management" are given:

1. The development of a true science.
2. The scientific selection of the workman.

3. His scientific education and development.
4. Intimate, friendly coöperation between the management and men.

But this statement is really unfair to Taylor. He deserves all the credit which has been set down to him as the great pioneer in the American movement; but he was not skilled in exposition and this list is really unrepresentative. By piecing together his writings and his practice we can get a much better notion of his thought. Something like this seems fairer to him than his own list:

A. The improvement and standardization of the productive organization and of the material equipment of the plant. This involves the rearrangement of plant equipment to secure the quickest routing; the reorganization of the managerial force on the basis of the division of function; the use of cost-accounting; the improvement of store-keeping methods and the adoption of mnemonic systems for classifying implements and manufactured products; the development of measuring devices such as the slide-rule—and various other improvements over existing practice.

B. The improvement and standardization, for each job, of the acts or movements of workmen. Under the systems of management commonly in vogue, the management does not and cannot know the great mass of traditional and habitual rule-of-thumb knowledge which workers use; it can therefore give them little help or advice and must leave them to carry out each task as they see fit. But "among the various methods and implements used" there is always one method and one implement which is quicker and better than the rest; and this one best method and best implement can be discovered and developed only through scientific study and analysis of all the methods and implements in use, together with accurate, minute time and motion study.

C. The standard task, based on an elementary time study and assigned by the planning department. The first uses of time study are in the elimination of unnecessary motions, the standardization of the operation, and the assignment to unskilled laborers, when possible, of routine operations not requiring skill. After the improvement of methods the movements are, if it seems necessary, timed again.[1] The planning department then fixes a standard time—a "task"—for each operation, based on observation of the minimum, average, and longest times required for the operation. Then an instruction card is made out, informing workmen what motions to perform and what standard task has been set up.

D. Functional foremanship in which the single supervisor is replaced by a number—ideally, seven—of specialized teacher-supervisors (inspector, gang-boss, speed-boss, repair-boss, time clerk, routing clerk, and disciplinarian) and the management substitutes friendly coöperation with workers for the suspicious driving of the system inherited from entrepreneur industrial organization.

E. The differential wage—a "bonus," or higher piece-rate—is given to the worker who makes or exceeds the set "task."

These make a fair statement of Taylor's principles. Another prominent worker in the field, Mr. Harrington Emerson, somewhat later (in 1913) published a book which he called *Twelve Principles of Efficiency*. The twelve principles, listed, are as follows:

1. Clearly defined ideals.
2. Common sense.
3. Competent counsel.
4. Discipline.

[1] A good modern illustration of the gains from motion study may be had by referring to an article by J. A. Diactelli in the December, 1925, *Bulletin of the Taylor Society*.

5. The fair deal.
6. Reliable, immediate, and adequate records.
7. Dispatching.
8. Standards and schedules.
9. Standardized conditions.
10. Standardized operation.
11. Written standard-practice instructions.
12. Efficiency reward.

We have obviously traveled a considerable distance since Mr. Emerson's time, as anyone can see by comparing his twelve principles with Mr. Alford's twenty-seven, soon to be quoted. Some of them are obviously trite; some are meaningless; some are amiable gestures toward a wished-for good will. There is no clear effort of thought which isolates each instrument from the others for analysis. There is more suggestiveness in a page of Taylor, awkward as he was in expression, than in all of Emerson's argument about principles. They do, nevertheless show something which has been of great subsequent importance. They begin to pay attention to matters outside the strictly technical field, a development which was forced by the warm reception which was given by labor everywhere to scientific management of the rigid Taylor type. This taking into account of externals, which of course do affect productivity in a very real sense, will be seen to have gone very much further in such systems of principle as that of Mr. Alford or Mr. Brown to which we shall shortly refer.

Outside of interest in management by technicians and management experts in the United States, perhaps the most serious attempt to get at the secret of our success has been made by two young British engineers, Messrs. Austin and Lloyd, who came to this country determined,

if they could, to find out why we were so rapidly outstripping Britain. We may, for a moment, turn to their account of our success. What they discovered—or thought they discovered—was embodied in nine principles.[1]

They were too naïve in their assumption that their principles are universal to the United States, but they unquestionably made some acute observations of what is best in our system. Perhaps we can gain something in our search for the secret of productivity by examining these generalizations of theirs:

A. The success of an enterprise is, in a large measure, dependent upon a strict adherence to the policy of promotion of staff by merit and ability only.

B. It is more advantageous to increase total profits by reducing prices to the consumer, at the same time maintaining or improving quality, with a consequent increase in the volume of sales, than by attempting to maintain or raise prices.

C. Rapidity of turnover makes for relatively small requirements of both funded and working capital, *i. e.*, the capital required for shop space including equipment, and the finance of work in progress.

D. The productive capacity per capita of labor can be increased without limit depending upon the progress made in time- and trouble-saving appliances.

E. It is better that labor should be rewarded by wages bearing some relation to output rather than by a fixed wage, the amount of wages earned by any one man being in no way limited. Contrary to the general belief in Europe, high wages do not necessarily mean a high level of prices. It is to the advantage of the community that the policy of industrial management should be directed toward raising wages and reducing prices.

[1] *The Secret of High Wages*, 1926. By Bertram Austin and W. Francis Lloyd.

F. A free exchange of ideas between competing firms should be advocated.
G. Elimination of waste is an essential factor in the attainment of national prosperity.
H. It is important that every possible attention be paid to the welfare of employees.
I. Research and experimental work are of prime importance to progress.

This is what the alert Britishers saw, or thought they saw, in the United States. Perhaps they overestimated the prevalence of these undoubtedly desirable practices, but they succeeded in interesting a wide audience at home in what they called the "secret of high wages." It is interesting to see that they did penetrate to some of the causes for productivity which American engineers have recognized for a considerable time. Such practices as promotion by merit, producing for volume, speeding up turnover, and the rest, which they enumerate, are admittedly important and appear in nearly every account of the causes of our productivity; but they appear to have overlooked such important ones as the continuous process and complete serialization, the superiority of American accounting practice, the superiority of large over small scale units, and others of equal importance, including all those we shall enumerate under the head of general causes. It should be said in passing that we are certainly not superior to Britain in all of these, which may account for the omission. They were looking for definitely superior American practices which might contribute to their own development; but their observations, though shrewd, were, to an extent, inaccurate, and hardly complete.

The similar effort of Mr. L. P. Alford, already referred to, deserves much more serious consideration. In a recent

paper [1] he stated what seem to him to be the accepted "laws of management." Mr. Alford is the editor of *Manufacturing Industries* and in an unusually good position to generalize from engineering technique. His "laws" are really working rules of best present practice. He claims for them that they are "resistant to change, universal in application, and imperative to the highest achievement." As a comment on this rather extensive claim an editorial from the *Bulletin of the Taylor Society* (December, 1925) may be quoted:

> There is no denying the assertion that there is not yet a science of management. There is scientific method in attacking the problems of management; there have been established a few basic principles, such as the separation of planning and execution under certain circumstances; but there is no substantial body of principles sufficient to eliminate uncertainty and chance in any considerable degree from managerial operations. What some are in a hurry to call a science of management is characterized by a large body of doubting observers as a collection of hypotheses, a creation of the imagination.

This is an eminently sensible point of view and one which will advance managerial study much more rapidly than the claim for our present hypotheses that they are laws.

Mr. Alford's principles of practice are merely listed here. For discussion of each of them, readers are referred to his paper:

1. Laws of Specialization.
   - A. Law of Division of work or specialization of the job.
   - B. Law of Division of effort or specialization of the individual.

[1] Read before the December, 1926, meeting of the American Society of Mechanical Engineers in New York City.

C. The Corollary Law of functional management (functional foremanship) or specialization of the management.

D. Law of Transfer of skill or specialization of tools and machines.

E. Law of Simplification or specialization of product.

2. Law of Standardization and its Corollary of Interchangeable Manufacture.

(Fixing the types, sizes, and characteristics of product reduces the cost of its manufacture. Corollary: Interchangeable manufacture reduces manufacturing cost and, all other characteristics being equal, produces a product of maximum serviceability.)

3. Law of Responsibility and Authority.

(Responsibility for the execution of work must be accompanied by the authority to control and direct the means for doing the work.)

4. Law of Leadership.

(Wise leadership is more essential to successful operation than extensive organization or perfect equipment.)

5. Law of Exceptions.

(Managerial efficiency is greatly increased by concentrating managerial attention solely upon those executive matters which are variations from routine, plan or standard.)

6. Laws of the Task and the Wage Incentive.

(A. The average worker accomplishes most when assigned a definite amount of work to be done in a given time.)

(B. An adequate wage incentive for the accomplishment of a definite task influences a workman to maintain his maximum output.)

7. Law of Individual Productivity.

(The highest individual productivity is possible only when the worker is given the highest class of work for which his natural abilities fit him.)

8. Laws of Economic Production.

A. Production at an Increasing Relative Rate.

(The unit cost of production decreases when the

rate of increase in output increases faster than the rate of input or use of the production factors.)

B. Production at a Decreasing Relative Rate.

(The unit cost of production increases when the rate of increase in output increases at a lower rate than the rate of input or use of the production factors.)

and

(The unit cost of production increases when the rate of output decreases and the rate of input or use of the production factors increases.)

9. Laws of Mass Production.
   (A. Large-scale production tends to increase operating efficiency and competitive power.)
   (B. In large-scale production the unit time of production tends to approach the actual operating time as a limit.)
10. Law of Production Control.
   (The highest efficiency in production is obtained by producing the required quantity of product, of the required quality, at the required time, by the best and cheapest method.)
11. Law of Planning or Law of Mental Labor of Production.
   (The mental labor of production is reduced to a minimum by planning before work is started: what work shall be done, how the work shall be done, where the work shall be done and when the work shall be done.)
12. Laws of Material Control.
   (A. The highest efficiency in the utilization of materials is obtained by providing the required quantity, of the required quality and condition, at the required time and place.)
   (B. The highest efficiency in the storage of materials, tools and supplies is obtained by providing a definite place to store every item, keeping every item in its assigned place, and keeping an adequate record thereof.)
13. Laws of Quality Control and Inspection.
   (A. The quality of manufactured goods is a variable with

an upward trend under conditions of competitive manufacture.)

(B. Control of quality increases output of salable goods, decreases costs of production and distribution, and makes economic mass production possible.)

(C. The inspection function in manufacturing—measuring and judging production—for highest efficiency must be independent of, but coördinate with, the functions of engineering, production and sales.)

14. Laws of Wages.

A. Law of Relative Wages.

(Wages tend to lower when the supply of labor exceeds the demand; wages tend to rise when the supply of labor is insufficient to satisfy the demand.)

B. Law of Wage Level.

(The normal wage level of each country depends upon, and corresponds, to that country's general average productivity of labor.)

15. Law of Wage Rates.

(Wage rates on standardized jobs should never be changed except in the case of a material change having previously been made in conditions, methods or equipment.)

16. Laws of Hours of Work.

(All other factors influencing production being constant, a decrease in the hours of work increases the leisure of the workers, an increase in the hours of work increases the comfort of the workers.)

17. Laws of Acquiring Skill.

A. Law of Speed.

(As the newly-acquired nerve path is strengthened, the new response tends to proceed more rapidly.)

B. Law of Accuracy.

(As the new connections between impressions and memories improve, there are fewer useless and erroneous movements, the response becoming more precise and more accurate.)

C. Law of Learning.

(Under usual conditions an average worker acquires

skill rapidly during the first half of the training period, then more slowly for a time if at all, and finally at a rapid rate until average proficiency is attained.)

18. Laws of Hand Motions in Doing Work (Gilbreth).
    (A. Both hands should work and rest at the same time.)
    (B. Both hands should begin and complete their "therbligs" at the same time.)
    (C. The arms should move in opposite and symmetrical directions.)
    (D. The paths of fast motions should be taught and learned.)
    (E. The sequence of fewest "therbligs" is usually the best way of doing work.)
19. Law of Motion Time (Segur).
    (Within practical limits the times required by all expert workers to perform true fundamental motions are constant.)
20. Law of Delay Allowances (Barth).

$$(P = 20 + \frac{49.5 - 0.326\,c}{\sqrt{0.376 - 0.0000216c^2 + h}} \text{ where}$$

    h = estimated minimum time study handling time for an entire cycle of operations on a job.
    c = the percentage that "h" is of entire cycle of operations.
    P = the percentage by which "h" is to be increased—the allowance percentage—to give the handling portion of the total task time for the entire cycle.)
21. Law of Manufacturing Cost.
    (The manufacturing cost of an article includes only those expenses actually necessary for its production. Corollary: The indirect expense chargeable to the output of a factory should bear the same ratio to the indirect expense necessary to run the factory at normal capacity as the output in question bears to the normal output of the factory [Gantt].)
22. Law of Profit.
    (A steady and reasonable profit can only come as the reward for rendering essential service.)

23. Law of Plant Maintenance.
    (Anticipating repairs and replacements prevents interruptions due to bad-order or broken-down equipment.)
24. Law of Flow of Work.
    (The greatest economy in progressing materials through a manufacturing plant is secured when the materials move minimum distances in passing from operation to operation.)
25. Law of Discrimination.
    (Sensations increase in arithmetical progression as the stimuli increase in geometrical progression [Weber].)
26. Law of Economic Lot Size.
    (The quantity of product which can be manufactured at the lowest unit cost varies directly as the square root of the preparation costs and inversely as the square root of the interest charge, and storage charge.)
27. Laws of Economy of Labor-Saving Equipment.
    (For the formulæ see Mr. Alford's paper.)

Another set of principles, carefully formulated by Mr. Geoffrey Brown, an industrial engineer of more than fifteen years' experience, will be the last of these lists to which we shall give attention.[1] These are included particularly because of the unusual attention paid by Mr. Brown to the necessity of coöperation with workers in a program of scientific management and because of their general careful statement and fine balance.

1. The recognition of trade unionism and coöperation with the labor movement in the elimination of waste.
2. Participation of workmen in the subjective and creative sides of industry through the medium of joint committees.
3. The systematic discovery by general investigation of the best way in which work should be performed.
4. The utmost possible standardization of tools, equipment, operations and products so as to permit maximum production.

[1] They were published in the course of a series of articles for *The American Federationist* in September, October and November, 1925.

5. The definite planning in advance, through the medium of schedules, route cards and charts, of the movement of materials, tools, components, and finished product through all the stages of production.
6. The economical production and utilization of steam and electric power.
7. The proportional distribution of overhead expenses in terms of departments, processes and machines; and their subsequent allocation in proper amounts to each shop order passing through production.
8. The preparation of cost sheets showing the correct labor cost, material cost, and approximate overhead expense incurred by each shop order.
9. The preparation of monthly profit and loss statements showing the comparative profit and loss and general economic values of different products.
10. The intelligent forecasting and guidance of expenditures through master and departmental budgets.
11. The systematic salvage of reclaimable waste-material, and the reclamation and utilization or sale of by-products.
12. Payment of the highest general wages compatible with an economic labor cost. If workmen are organized, payment of whatever wage scale is established by agreement with accredited union representatives.
13. Maintenance of good illumination, and working conditions as sanitary and attractive as the character of the work will admit.
14. The scientific placement of workers—each worker in the place where he or she will work most contentedly and most effectively.

Some of these attempts to formulate the accepted rules of procedure, it will be noticed, confine themselves pretty strictly to internal factory management. This is what we should expect from the engineers who are interested most of all in technique. Taylor's principles have to do with the internal workings of an industrial unit. So, generally, do those of Messrs. Emerson and Alford. Those

of the British engineers, Messrs. Austin and Lloyd, have to do with our general policy as contrasted with that of the British and so have some reference to the social situation.

2. *Some raw material and a new list of possible causes.*

No one who is unfamiliar with industrial technique or, indeed, who has not made something of a special study of the technique involved in the modern campaign for efficiency is entitled to speculate concerning what may be the formative strategies and determinative incidents of that campaign. Perhaps, however, the presentation, in tabular form, of a series of advances in technique, with the gains and causes assigned for them by those in direct responsibility will make it possible for even the uninformed to appreciate the magnitude of the movement and some of the tactical issues involved.

For this purpose there may be submitted a table, pp. 44–61, gathered from many sources and on the whole giving a random but representative notion of what actually is taking place in industry.[1] By first studying this tabulation of the ways in which productivity is increased we shall have a more realistic approach to the discussion of causes. It takes us into the operating system, shows how a gain is made here and there, sometimes of one sort, sometimes of another, depending upon the genius which comes to be applied to a particular problem as it arises. For this is the way in which gains in the past have characteristically taken place. The point has already been made that most gains occur in this specific and independent fashion, without the principle of the whole movement having been appre-

[1] It was put together by Mr. Alford, already quoted here on the causes of efficiency, and was published in *Manufacturing Industries*, of which he is the editor, in the September, 1926, issue of that journal.

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Burroughs Adding Machine Company	Wage-payment plan to aid in securing greater production at lower cost	Differential wage payment plan	Greater production at lower cost; satisfactory conditions for employees; easy method of adjusting wages
Buick Motor Car Company	Reduction of manufacturing expenses	Scientific study made of every detail of operation costs; equipment and processes improved; wastes and losses eliminated	Nine months' savings totaled $3,500,000
Cadillac Motor Car Co.	Maintenance of established quality	Inspection organization; one out of every sixteen workers assigned to inspection	On the Cadillac car 36,000 operations have permissible limit of error of 0.002 in.; 22,000 a limit of 0.001 in.; and 800 limits from 0.0005 to 0.00025 in.
Buick Motor Car Co.	Reduction in cost of export shipping	Method of shipping automobiles unbolted	Saves approximately $100 on every car exported in this way
Ford Motor Car Co.	Reclaim manufacturing wastes	Salvage and reclaiming department with necessary equipment to collect and recondition all kinds of waste	Savings at the rate of $15,000,000 per year, or over $7.50 per car produced

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
General Motors Corp.	More efficient use of financial resources	System of transferring funds among the various units and subsidiaries	Control of distribution and borrowing of funds; reduction of funds; reduction of funds in transit, efficient use of working capital
Nash Motor Co.	Reduction in cost of handling cylinder blocks	Standard conveying equipment	Savings of $8,600 per year
Willys-Overland, Inc.: Automobiles	Means to check overproduction	Market analysis to predict volume of forthcoming orders	Production is kept in step with sales demand through systems of monthly quotas; prompt shipments are assured
Edward G. Budd Manufacturing Co.: Automobile bodies	Effective material control	Continuous process system with planning department functionalized into operating and statistical sections	Hourly check on all production; reduction of process inventory losses by 95 per cent
Willys-Morrow Co.: Automobile accessories	Reduction in cost of power	Coal handling equipment; stokers, condensing equipment, and boiler-room instruments	Saving of $67,200 per year

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Fisher Body Co.: Automobile bodies	Better artificial lighting in body finishing departments	Cooper-Hewitt lamps	Working hours reduced from 58 to 48 per week; saving in overtime wages $400 per week or $20,000 per year
Kelsey Wheel Co.: Automobile wheels	Reduction in foundry handling costs and production costs	Link belt conveyors	Savings of $10,000 per year
Hyatt Roller Bearing Co.: Bearings	To route work in process in most efficient sequence, decrease fatigue of workers and handle work at lowest cost	Logical arrangement of machines and departments with gravity conveyors to handle work in process	Efficient routing of work; annual earnings of conveyors 38 per cent on investment
New Departure Mfg. Co.: Bearings	Reduction in costs of handling annealing pots	Lakewood tier-lift trucks	Savings of $10,800 per year
George Ehret Brewery: Beverages	Reduction in cost of handling coal and ashes	Hunt bucket conveyor	Equipment handles 20,000 tons of coal per year at cost of 9 cents per ton
Pioneer Box Co.: Boxes	Increased production and purchase control	Material control and bonus payment	Output increased 25 per cent, quality improved; 95 per cent of orders shipped on time

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
United Metal Co.: Brass	Reduction in cost of handling material	Louden overhead carrying system	Savings of $7,500 per year
Crume Brick Co.: Bricks	Reduction in cost of handling sand and gravel	Barber-Greene portable conveyor and loader	Savings of $3,900 per year
Davis and Thomas Co.: Castings	Reduction in cost of charging cupola	P. H. & F. M. Roots charging hoist	Savings of $5,850 per year
Ferro Machine and Foundry Co.: Castings	Better natural illumination	Systematic cleaning of factory windows	Illumination increased from 3 to 11 ft. candles, a gain of 266 per cent
Southside Malleable Castings Co.	Reduction in costs of handling materials	Three Clark truck tractors	Savings of $22,500 per year
Edison Portland Cement Co.: Cement	Coördination of sales and production	Budgetary control system	Actual cost of cement in bins 99½ per cent correct, according to budget; products 95 per cent correct; sales 96 per cent correct, profits 92 per cent correct
Cree Patent Column Co.: Cement columns	Reduction in handling costs	Two Shepard lift-about hoists	Savings of over $6,000 per year

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
American Chain Co.	Reduction in shipping costs	Wirebound boxes adopted as shipping containers	Savings of $52,000 per year
Samoset Chocolate Co.: Confectionery	Reduction in cost of handling boxes and cartons of candy	Mathews gravity conveying and special chutes system	Savings of $3,370 per year
Canister Co. of New Jersey: Containers	Increased production	Analyzed orders for similarities; established executive functions; put in production control	In 2½ months production doubled
Matthews Conveying Co.: Conveyors	Means to apportion operating charges of conveyors to work handled	Modified form of machine hour rate	For system described the savings in labor amounted to 38 hours per day
Jackson Mills: Cottons	Increased production and material control	Complete system of conveyors	Savings in handling $16,500 per year; successful material control, improvement in machine operation
Milstead Mfg. Co.: Cotton duck	Reduction in cost of conveying raw cotton	Sturtevant pneumatic conveyor	Savings of $1,600 per year

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Ritter Dental Mfg. Co.: Dental supplies	Decreased cost of automatic screw machine work	Group premium plan	30 per cent decrease in working force of department with increase in production
Ritter Dental Mfg. Co.: Dental supplies	Cost control	System of standard costs	Reduction in expenses; satisfied employees; better operating conditions
Ireland and Matthews Drop Forge Co.	Reduction in cost of changing dies	Lakewood tier-lift truck	Savings of over $32,000 per year
E. R. Squibb & Sons: Drugs	Economical handling of goods and materials	Complete system of conveying, elevators, chutes and gravity devices	Elimination of increasing travel of material-in-process and finished product
Thos. A. Edison Industries, Ediphone division	Coördination of sales and production	Budgetary control system	Estimates 94 per cent correct as regards sales; 93 per cent as regards profits
Delco Light Co.: Electrical apparatus	Coördination of sales and production	Budgetary control	Definite plan of action as regards sales and production; regulation of expenditures and determination of major policies

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
General Electric Co.	Reduction of indirect or nonproductive expense	Changes in supplies, equipment and office routine	$52,000 saved annually in small office items
Reliance Electric and Engineering Co.	Reduction in cost of handling material	Three Euclid Cranes	Savings of $9,350 per year
Westinghouse Electric & Mfg. Co.	Salvage and reclaim materials, tools & supplies	Complete organization to reclaim and recondition	Remarkable saving and economic re-use of materials
Westinghouse Electric & Mfg. Co.	Reduction in cost of delivering small packages through the plant	Three shop express routes each about 9,500 feet long and each served by an electric truck	Delivery cost per package reduced from $.15 to .044
Consolidated Gas, Electric Light & Power Co.	Greater production at lower cost	System of selecting and promoting steam power station employees	Carefully selected and trained employees; improvement in quantity and quality of service
Westinghouse Electric Products Co.: Electric irons	Increase in production, decrease in costs	Development of straight line production with full use of conveyors in processing and assembling	Capacity now 50,000 irons per day; costs reduced resulting in cut of $1.00 in consumer price

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Otis Elevator Co.: Elevators	Reduction in cost of material handling	Organization of all handling under a superintendent of traffic and selection of equipment best suited for the work to be done	Thirty-five men handle 900 tons of incoming and practically the same amount of outgoing material per day
Liquid Carbonic Co.: Equipment and supplies for carbonated beverages	Coördination of production with sales and demand. Control of amount and character of inventory	Complete budget program and control	$8,000,000 of sales handled annually under program approved by executive committee
Beech-Nut Packing Co.: Food products	Control of purchased material	Material schedules prepared from sales estimates; purchase schedule based on time and follow-up sheets to check delivery	Efficient control of purchase for a highly seasonal business
Heinz and Munschaur: Furniture	Increased output and lower unit costs	Production control system with wage incentive in two departments	Increase of 50 per cent in capacity, 33$^1/_3$ per cent in output, cost reduction of 50 per cent on some operations

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Hoosier Mfg. Co.: Furniture	Reduction in material and labor costs and reward improvement in higher wages	Combined waste and production bonus plan	In the various departments the production increase was up to 30 per cent; material efficiency improved up to 21 per cent and total bonus paid varied up to 19 per cent
C. G. Gunther's Sons: Furs	Better control of production	New lighting system, rearrangement of manufacturing departments, production control system	20 per cent of manufacturing floor space released, numerous operations eliminated; production control with reduction in manufacturing costs
Bisbee Linseed Co.: Grain	Reduction in handling flaxseed from ship to storage tank and hence to mill	Weller conveying and elevating system	Savings of $15,000 per year
Walworth Co.: Heavy hardware	Estimate of forthcoming orders	System of forecasting and budgets based thereon	More prompt shipment of goods, better use of production factors, steadier work for employees
Rion Knitting Works: Hosiery	Executive control of complete operation	System of charts to show performance trends and exceptions	Satisfactory control of progress of the business, manufacturing costs, distribution and administrative expense

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Sperry Gyroscope Co.: Instruments	Wage scales scientifically set and fair to all grades of workers in a craft and for workers in various crafts	An evaluation system for occupations	Wage scales fair to employees and employer
Delaware River Steel Co.: Iron and Steel	Reduction in handling cost	Fifteen Brown hoist locomotive cranes operating on a stock pile	Savings of $10,300 per year
Sloss-Sheffield Steel and Iron Co.	Economical load balance on boilers	Republic steam flow meters	Savings in fuel, $22,400 per year
Joseph Eisendrath Co.: Leather	Reduction in cost of handling fleshings	Mercury tractor	Savings of $3,400 per year
Griess-Pfleger Tanning Co.: Leather	Reduction in cost of handling patent leather in frames	Louden overhead carrying system	Savings of $5,000 per year
Sullivan Machine Co.: Machinery	Reduction in inventories; better managerial control	Management methods of late H. L. Gantt to put managerial policies into effect	Improvement in good will among departments; reduction in inventory; 85 per cent of orders shipped on time

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Bullard Machine Tool Co.	Reduction in cost of handling material	Two Clark truck tractors	Savings of $10,500 per year
Armour and Co.: Meat products	Better control of production and marketing operations	General budgetary system	Setting definite objectives for the company as a whole; forestalling possible losses; reduction of expenses, for instance, a 5 per cent reduction in unit costs in one year
White Provision Co.: Meat products	Reduction in shipping costs	Wirebound boxes adopted as shipping containers	Savings of $9,000 per year
Jacques Kahn, Inc.: Mirrors	Reduction in cost of power	Flow meters installed; power-plant force reorganized	Savings of $9,100 per year
Jacques Kahn, Inc.: Mirrors	Reduction in production costs	System of standard costs; budgeting of all expenses; production control	Almost immediate reduction in manufacturing costs; in three months reduction was 21 per cent
American Writing Paper Co.	Control and coördination of administrative, sales, and manufacturing activities	General budgetary system	Sales estimates were 96 per cent correct; production 104 per cent of estimates; manufacturing expenses within 5 per cent of estimates

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Peterson Parchment Paper Co.: Paper	Reduction in cost of handling paper in rolls to cutting machine	Five link-belt hoists	Savings of $4,100 per year
Atlantic Refining Co.: Petroleum products	Greater efficiency from laboring gang (largely negro) engaged handling filled oil barrels	Piece rates and group bonus	Ninety per cent increase in labor efficiency
Sun Oil Co.: Petroleum products	Better boiler efficiency	Republic Co. recorders	Savings in fuel of $38,000 per year
White Eagle Oil and Refining Co.	Better boiler feed water	Graves water softener, 9,000 gallons capacity	Savings of $20,000 per year
Columbia Phonograph Co.	Control of manufacturing to ship product in quickest possible time consistent with quality and reasonable inventory	Flexible control system based on law of exceptions	Ninety-five per cent of dealers' orders shipped in 24 hours, 90 per cent branch and jobber orders shipped in 10 days, inventory turnover 24 times per year
Detroit Piston Ring Co.	Better artificial lighting	General lighting system with intensity of 14 ft. candles. Former drop cord system had intensity of 12 ft. candles	Production increased 25.8 per cent. Lighting costs increased 48 per cent, this represented but 2 per cent of payroll

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Champion Porcelain Co.: Porcelain products	Reduction in cost of handling clay	Clark truck tractors	Savings of $8,400 per year
Worthington Pump and Machinery Corporation	Reduction in tool costs	Complete tool control system with physical rearrangement of tool cribs and supply rooms	Control established over tool repair costs. Annual dull maintenance costs reduced 50 per cent
Thomas A. Edison Industries: Primary batteries	Coördination of sales and production	Budgetary control system	Estimates 97 per cent correct as to sales and 98 per cent correct as to profits
Kelly Press Division, Amer. Type Foundry Co.: Printing presses	Production control	All work classified "round" or "flat" and segregated for machinery. Control boards developed and installed	Control of production secured and trucking reduced 50 per cent
Eastern Manufacturing Co.: Pulp and paper	Quicker and cheaper repair and maintenance work	Time studies and instruction for repairs and maintenance with bonus	Time on jobs reduced 54 per cent: earnings of workers 43 per cent higher on bonus than day work

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
American Sugar Refining Co.	Reduction in cost of packaging and handling sugar	Automatic packaging and handling equipment	Estimated saving of one-half labor cost
Godchaux Sugars, Inc.	Methods to fix fair selling prices	Curves for all elements of cost; daily reports on production and current position	Daily presentation of all current facts on costs, manufacturing and competitive positions from which fair selling prices are set
National Sugar Refining Co.	Reduction in cost of handling cartons packed	Matthews conveyors	Savings of $8,800 per year
Barber Asphalt Co.	Reduction in shipping costs	Motion study of operations; engineering study of packing and bracing materials, established standard practice	Costs reduced up to 22 per cent, wages increased up to 60 per cent, labor turnover eliminated
Barber Asphalt Co.	Perpetuation and continued utilization of operating improvements	Adequate records of new standards and a system of instruction cards	Savings due to improvements are four times the cost of their installation

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
The Barrett Co.: Roofing materials	Reduction in shipping costs	Operation and time studies were made of all the work, time allowances set, time formula developed for loading a truck, and a bonus system established	Labor costs cut 37 per cent
Essex Rubber Co.: Rubber goods	Reduction in cost of power	Boiler room instruments installed, results of operation measured; work made interesting to men	Efficiency of boiler plant increased from 65 to 72 per cent
Miller Rubber Co.: Rubber goods	Better boiler efficiency	Vulcan soot blowers	Savings in fuel $6,200 per year
Benedict Manufacturing Co.: Silverware	Increase in production without increasing investment in equipment	Rearrangements of machinery and departments; production control system	Production increased from 45 per cent to 52 per cent; factory costs reduced 20 per cent
B. T. Babbitt Co.: Soap	Better routing and material handling	Complete conveyor system for entire plant	Unloading costs of $0.02 per lot for metal can; $0.02 for caustic soda; $0.04 for lime; $0.50 per thousand for wooden boxes. Shipping costs $0.0075 per package

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
American Radiator Co.	Reduction in handling costs	Two Clark truck tractors in malleable iron plant	Savings of $22,000 per year
American Rolling Mill Co.: Steel sheets	Efficiency information and improved payroll system	Methods of payroll accounting	Daily balanced payroll; daily efficiency reports; no payroll disputes
Johnson and Johnson: Surgical supplies	Organization of plant maintenance and employment work	A service department under a superintendent having three divisions: plant maintenance, plant engineering, and employment	Output per man on maintenance work increased 15 per cent; design and building of new equipment more economical than under outside contract
Moss Rose Manufacturing Co.: Tapestry	Standard rates for design costs	A schedule of standard rates arranged in geometrical progression, and depending upon the cost of the design	Actual and estimated design costs kept in substantial agreement
New England Butt Co.: Textile machinery	Better management and control	Taylor system of management	After 10 years of operation system is eminently successful, output has increased, 20 per cent of operations have been eliminated

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Continued*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Universal Winding Co.: Textile machinery	Improved management and operation	Taylor system of scientific management; important elements being pre-planning of work and fixing proper responsibilities on the management	Production per employee has increased 100 per cent over a period of 12 years
Architectual Tile Co.: Tiles	Reduction in cost of handling material	Louden overhead carrying system	Savings of $5,000 per year
Tin Decorating Co.: Tin cans	Reduction in cost of internal transportation	Matthews elevating conveyors	Savings of $47,400 per year
Mason Tire & Rubber Co.	Increased production per man as means to reduce manufacturing costs	Scientific piece rates	Production increased approximately 40 per cent
Hood Rubber Products Co.	Establish and maintain satisfactory ratio between sales expense and sales volume	Budgetary control of sales expense and volume	Actual ratio only ½ of 1 per cent from estimate

TABLE OF 100 CASES OF IMPROVEMENT IN MANUFACTURING OPERATION—*Concluded*

Company and Product	*Improvement Desired*	*Betterments Installed*	*Results of Improvement*
Caterpillar Tractor Co.: Tractors	To reorganize and re-establish manufacturing procedure after the war	Complete system of production control	Outstanding record of 995 consecutive working days with production exactly according to schedule; improvement in product; lower manufacturing cost
Holt Manufacturing Co.: Tractors	Reduction in handling costs	Four Clark truck tractors and trailers to handle foundry supplies	Savings of $13,200 per year
Seymour Woolen Mills: Woolens	Better artificial lighting	Sixty-watt lamp in X-ray rube, tube reflectors, 8 ft. high over machine, 9½ ft. high over aisles. Illumination 5 ft. candles on working plane	Twenty per cent increase in production
Walther Manufacturing Co.: Woolens	Elimination of uncertain costs	Cost system; estimating expenses before incurred	Scientific costs suitable for pricing; control of expenses; discovery of unprofitable items

ciated. It is as though a military campaign were to be fought by independent commanders without the assistance of a working plan, definitely formulated objectives, or a general staff. Perhaps if the objective could be made clear, the means surveyed, and the necessary plan worked out, this particular social campaign might progress with greater rapidity and a more certain chance of success.[1]

And now, after studying the ways in which improvements characteristically happen in industry, we may go on to the making of a new list of causes, including suggestions from divers sources which are far too numerous for specific reference. Yet all of them are relevant to the processes actually going on as they were revealed in our cross-section table—for that is what it is, a cross-section of intelligence at work in industry. The list which follows is a generalization of such data as this, and an attempt to discover in the mass of changing phenomena the inventions and discoveries which are really formative. For not all changes involve movement forward. Some of them, in spite of the optimism of their inventors or supporters, may actually be retrogressive; some of them may simply be of no real account. What is wanted here is to put an inquiring finger on those suggestions which seem most likely to be assisting in our present unconscious campaign.

This is the list:

A. General Causes.

1. The spread of general and technical education in the United States.
2. The inheritance of and addition to the racial store of technical skills and knowledges.

[1] *Cf.* "Purpose as a Psychological Factor in Management," by Ordway Tead, *Bulletin of the Taylor Society*, December, 1925.

3. Changes in the size and pattern of our population.
4. Progress toward the more complete division of labor and the consequent mechanization of industrial processes.
5. Reduction of stoppages of and interferences with industrial activity which we group under the name of "depression."
6. Our recent taking advantage of the possible productive contributions of women.
7. Better arrangement of our consuming lives which adds greatly to our productive power.
8. The development of combination and association among businesses.
9. The cumulative nature of "surplus," of which we have more than was possessed by any other economy.

B. Specific or Technical Causes.

1. The discovery and spread of "scientific management" and the elimination of rule-of-thumb.
2. Directed industrial research and controlled invention.
3. Standardization of many basic materials and processes.
4. The continuous process and the serialization of machines.
5. Improved layout, location, and routing practice.
6. Careful pre-planning and enlarged reliance on paperwork.
7. Better general organization of the executive function and the development of the rule of exceptions.
8. Better accounting control which gives the executive more instant and accurate knowledge of the affairs for the direction of which he is responsible.
9. Better financial operation based on more complete and accurate budgetary control.
10. Increasing the scale of operations, which results in a large volume of output with low per-unit costs.
11. Development of the policy of taking a relatively low price for a large volume as contrasted with a high price for a small volume.
12. Reduced inventory burdens, achieved through quicker turnover, simplified marketing, and improved transport and communication.

13. Reduction of trade ignorance and secrecy, resulting in a more rapid spread of improved practices, machines and processes.
14. The increase of salvage operations and other ways of reducing wastes.
15. Improved communication and transport facilities, and better organized exchange markets.
16. Improved financial mechanisms.
17. The bringing into use of new and better power resources more suited to our technique, more flexible and less wasteful; and continued progress in the technique of generating and applying power.
18. American readiness to scrap obsolete plant and equipment.
19. Study of personnel; use of care in the processes of hiring, shifting and promoting. Introduction of fitness tests; and the rule of promotion by merit.
20. Reorganization of methods of wage payment to achieve fairness and a maximum wage-incentive. And the pressure of high wage-scales and reduced hours making necessary much study of ways to cut costs besides lowering wages or increasing hours of work.
21. The spread of various schemes for increasing the welfare of employees at work, and for increasing democracy in control.
22. The tendency of unions to organize on an industrial basis. And the interest of unions in better management as one way to raise wages.

After having read this list and having realized that it is intended to survey the causes of productivity as completely as possible, but yet in a generalized way, some discussion of each point will be expected. We shall go on to this immediately.

CHAPTER III

DISCUSSION OF SUGGESTIONS TO ACCOUNT FOR OUR INCREASED PRODUCTIVITY: GENERAL CAUSES

1. *The spread of general and technical education.*

Notwithstanding the certainty that when we come to a list of the main barriers to progress, the backwardness of American education will have to be set down as one of the most important, still it is true also that this education factor deserves a place among the causes of our remarkable national achievement in the industrial field. The unaccustomed person who surveys, even cursorily, the spread of the educational idea during the nineteenth century will be surprised at what he finds. It is one of those matters which we take for granted now, so deeply has it become embedded among our traditions. But this was not true until very lately. One would have to go back only three or four generations to discover a time in which educational opportunity was highly exceptional, to be attained only by the most gifted and then only by luckily happening into a situation which made support for some years possible. In pioneer America all hands were needed for work. How many potentially fine geniuses in science, art, literature, music, or industrial engineering and management were wasted in the woodlots of hilly New England or on midwest plains we can never know. But perhaps a faint notion of how great this wastage was, may have had something to do with the development of our educational program.

What had more to do with its development, probably, was the democratic idea which we very early made our own —that and the increasing complexity of life. The remarkable persistence of the notion, even in the face of Mr. Mencken's frontal attack and Mr. Lippmann's more subtle undermining operations, that all men are born equal, is a major sociological phenomenon of our time. When John Locke formulated the idea of the child's mind as a tabula rasa, on which experience (including education) might write any glory, there was born an hypothesis which Americans found it congenial to test. Our forefathers did not conceive it as a theory to be tested, however; they never regarded it as unsubstantiated. To them it was law. And it formed the basis for a remarkable achievement. For, ever since, we have held as one of our least disputed ideals a program which looked toward free opportunity for every child to go as far in the educational system as he might care to go. Our approximation to the program is remarkably close. And only lately, and against immense pressure, have educators been able to shut the doors of their institutions here and there to obviously limited intelligences.

The part in this progress played by the swift change in American institutions seems obvious as we look back, though it was not obvious as it happened. In half a century we have become preponderantly an industrialized people. And industrialization carried with it the inevitable corollary of urbanization. Most Americans at one time worked on farms in the country. Now most of us work and live somewhere within urbanized areas. The technical qualifications for pioneer farming and homemaking were perhaps not simple, but they were most easily acquired on the farm itself—in the fields, the stables and

the woodlots, in the kitchens and at the looms. Education was not "schooling" in that life; it was apprenticeship. But even then it was commonly insisted that the three R's should be acquired and many stories still survive of our ancestors who broke their way through the deep snows of winter or the heavy mud of early spring and late fall to achieve what learning was customary and available.

As urbanization went on through the last century and as the surpluses of a prospering industrial system piled up, there was no hesitation in enlarging the scope of the ideal. Instead of giving everyone the three R's and only a very few anything more—clergymen, district-school-teachers and lawyers, mostly—we began the attempt to carry everyone further. Gradually it became customary to complete the eighth-grade, then to complete the high-school course; and now we seem to be on the verge of committing ourselves to collegiate training for nearly everyone. Soon, if we keep on, we shall be adding a postgraduate technical or professional course to that—a training still, at present, confined to the very few.

It may not at first be apparent why a boy or a girl who is to have a city instead of a country life, a business or professional career instead of that of a farmer, needs an extended schooling. But a little thought will supply the reason. City life is more complex. It depends more largely upon intellectual interchange. It possesses none of the instruments of social apprenticeship. Industry is carried on at a technical level which can only be attained by formal schooling. If workers are not, all of them, to be definitely sunk to the level of simple machine-tenders, they must be lifted by education and more and more of it. Not only that: industry sets up also a forthright

demand for technical training. A bank clerk, a machine draughtsman, or a factory foreman, may not have jobs which we rank very high in the social scale but their technical requirements are considerable; and they are more if we add to the minimum demands that extra training which makes promotion possible.

Luckily industry, with its increased educational necessities, also furnishes the wherewithal for their supply. It increases income; and it is from income that school taxes eventually have to come. One of the cycles of civilization comes into view here. Education furnishes industry with trained intelligences; industry gives back to education the income with which to make more trained minds. It does not happen so directly as this implies, of course, for most taxes come from personal, not corporate, incomes; but the effect is accurately pictured in calling it a cycle. If America is the most productive region on the earth, she also spends more than all the rest of the world put together on education.

The utility of education for industrial productivity has not, however, been very clearly seen; nor did we even foresee that this effect would follow from our devotion to the idea of universal education. The argument for enlarged training has usually been put on what were considered higher grounds, such as the right to culture or to the superior kind of existence supposed to be led by "the educated." When we examine these arguments they appear less sound usually, however, than the purely economic one. What better excuse for education could there be than that it "pays" in the sense of adding to our stocks of goods or the qualities of our services—so making the levels of living higher? The difficulty has been in the past that, though it might be admitted as a

general thing that education pays, so long as we had a disorganized and small-scale economic system there were no individuals to whom it could be made to seem to pay. This difficulty becomes less as business becomes bigger. One industrial organization, now, may comprehend a considerable section of social life. There are, indeed, several businesses in the United States whose annual expenditures are greater than that of the Federal Government in 1913. And such organizations begin to think of themselves in social terms—which means that what is socially good is good for the organization. When genuinely forward-looking men come into responsibility in our gigantic business structures, the businesses themselves tend to become socialized. This means concretely that they turn to the support of any part of our general social program which seems to offer a genuine advance. Most, though not all, of the difficulties arise because little men try to run big businesses. A little man cannot see far; possibly not beyond his year's balance sheet. And from him we cannot expect much. We have to rely on the movement of better intelligences into responsibility.

We can be properly thankful that an ideal, formulated for a quite different purpose, has served us so well in industry. But it would be a mistake to rely on old purposes to serve new ends too far. So we find industry becoming specifically interested in education for quite definite reasons. Better engineers, better accountants, better lawyers, better executives are wanted. The colleges hold the key to this situation and industry is coming to see the utility of collegiate education. Skepticism concerning much of the usual curriculum is certainly justified; but on the whole it shifts in the right direction. Schools of engineering and of business administration, within the

universities, multiply and grow stronger; the liberal arts college itself comes gradually to accept its responsibility of turning out people with preparation for carrying on a twentieth-century instead of a classical or medieval life. Not only this—the educational revolution becomes really a revolution in high school and grades. The project method is taking the place of rote learning; the school is becoming a part of the world and not a place apart from it. If the old education added to our economic life, the new will add infinitely more. It is, perhaps, our broadest reservoir of talent, our greatest single dependence for the future. We could multiply our expenditure on it by ten or by twenty and still gain from it an increasing return.[1]

2. *The inheritance of and additions to the racial store of technical skills and knowledges.*

Man differs generally from other animals in the power he has to conserve all his gains over nature. For, in a

[1] Readers are referred for further discussion of education in the technique of business and of the possibilities of such training to meet the essential ideal of the older "cultural education" to the *Proceedings of the Stanford Conference on Business Education*, Stanford Business Series, No. 1, published by the Stanford University Press. The remarks of Dean Willard E. Hotchkiss are particularly in point. See also such treatments of management education as "The Content of Courses in Management" by Messrs. Joseph W. Roe and N. W. Burleigh, in the February, 1925, issue of the *Bulletin of the Taylor Society*. Of even wider interest is L. C. Marshall's "The Collegiate School of Business at Erehwon," in the *Journal of Political Economy*, xxxiv, 289 ff. (June, 1926), in which the Dean of the School of Business Administration in the University of Chicago outlines an ideal plan for business training. Of possible interest also are accounts of foreign experience such as that by August Wilhelm Fehling in "Collegiate Education for Business in Germany," *ibid.*, xxxiv, 545 ff. (October, 1916). See also that of J. Wiesner and K. Ficek who explain "Education for Business in Czechoslovakia," *ibid.*, xxxiv, 141 ff. (April, 1926).

sense, man lives by nature's sufferance. This is not meant to imply that nature is niggardly—an idea of which so much was made by Malthus and his successors, but that, on the contrary, there exists a free store of materials and forces which it is man's problem to discover and to use. So far as we can discern, this store of materials and forces is illimitable. We have, indeed, gone so far already that we begin to have a vision of a future when man will have turned over to natural forces all the ancient tasks of providing food, clothing, and shelter which have been so great a burden and limitation in the past. For the progress we make, we are, however, dependent upon the imagination and the intelligence with which we approach nature. The greatest single advantage which man has over other animals, perhaps, is the care he takes to conserve his discoveries and inventions once they are made. A skill or a knowledge, acquired, becomes a permanent part of his equipment.

He differs also from other species—and this must be said to be a second great advantage—in his ability to incorporate the new gains he makes into a cultural body of productive arts, so that each generation builds on the work of all those which have gone before. The familiar illustration of the beaver and the dam is in point just here. Beavers are highly socialized animals and possess almost uncanny skills of their own kind; but they can only build characteristic beaver-dams. They never improve upon the kind of dam which suits their minimum needs. Man, placed in a similar situation, would be found to be continually experimenting with new forms and shapes, and before many generations had passed he would have added something, at least, to the design he had inherited. This power of man to use all his inheritance as

a foundation for new experimentation is a unique quality and must be said to account for a large part of his superiority.

When man takes what comes down to him from the past and goes on from that point, there is created an accelerating rate of accumulation for inherited technique. Each generation possesses more than the generation which preceded it, because it has been able to go on from the point where its ancestors left off. The rate of this acceleration has been the subject for considerable speculation, but no mathematical formula which covers it has been discovered. The rate of acceleration is really a joint function of man's intelligence and of the body of materials, skills, and knowledges which come down to each new generation. At any one time, knowledges or skills in certain fields may be in advance of those in certain others with which they must necessarily correlate to create further progress. Advance, then, has to wait until the problems set by the gaps in our knowledge can be solved. Or at any one time the genius to go forward may be lacking and for a long period of time, perhaps, no great new discoveries may be made. It is true that intelligence is fairly constant in the race, which is to say that if we suppose the range of intelligence to be from one to ten, there will, in different generations, be a constant proportion of ones and tens; so that we might expect progress—which depends upon intelligence—to be made at a constant rate. But intelligence is not always free to function. It may be smothered by poverty or slavery, as it has in the past. Or it may never happen to come into contact with the problem which would create a genuine advance for the race. We may conclude from this that cultural advances will be most rapid when there is the most equality

of opportunity, so that intelligence may have its chance to function; and when there is the greatest fluidity of information, so that the right intelligence may make the necessary contact with the problems it can solve. It may be inferred that our increase in productivity at the present time is in great part traceable to the advances we have made in the accumulation of skills and knowledges and in bringing intelligence into contact with relevant problems.

Some discoveries are more basic than others, if we are to judge by what results from them. Some of them flower luxuriantly into a whole new series of developments; some come to a dead end and have no further result than the contribution they make in themselves to industrial advance. Intelligences differ—even those which occur together, say, in the upper tenth of the range—in their ability to combine materials and processes for the creation of new materials, machines, or methods. For these reasons we cannot predict and can measure only in a rough way the progress we make.

If we were to search the past for the series of genuinely basic discoveries which have given us the firm foundation upon which our industrial culture now rests, we should have a comparatively short list, which would include such things as fire, the lever, the wheel, the alphabet, our system of numbers, the calculus, gravity, steam, electricity, the atomic scale, relativity, and others of a like nature, including possibly, the microscope, high-speed steel, the slide rule, and the vacuum tube. It would require a far longer list to include all the secondary discoveries which have emanated eventually from these basic ones. Both sorts are, of course, important; but obviously basic discoveries are of far greater importance than secondary ones and more of our progress is to be

allocated to them as causes than to the secondary ones, though it is admittedly difficult, many times to make any good distinction.

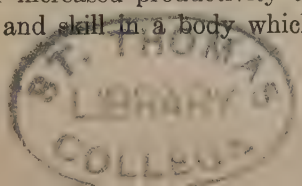
It is a favorable aspect of our modern world that not only is it easier to make secondary advances in our time than heretofore, but that it is also easier to make basic ones. This is because of the greater freedom we allow intelligence, and because of the greater accessibility of our bodies of information. No one can do so with any exactness, but it is to be imagined that if we constructed a time-chart upon which were marked the intervals between the great basic inventions, it would be found that those of modern times have come much nearer together than those which were made in that pre-history of our race which is veiled from us by the lack of written records. If we may assume this to be true, it follows that we may expect wide and deep changes in civilization to occur with greater and greater rapidity as time goes on, not to mention the lesser changes which will be caused by smaller, less basic, discoveries and inventions. But it is also possible, as many think, that there are plateaus of progress on which we rest for a time, with a slowing up of the rate of acceleration until some new fundamental discovery sets us off again upon a new steep climb.

Not with any adequate theory of this process, but for other reasons, we have come to have a society which does, after a fashion, provide both for conservation of knowledge and for its improvement. Language is our fundamental asset in conservation, but libraries and museums are our chief modern means of preventing loss. In them are stored imperishably the records of our past achievements, so that if some cataclysm should to-day destroy all the adult members of our race, a new generation could re-

construct our system completely from the records we have made. The school system is designed to bring new generations to adulthood in possession of the skills and knowledges we have inherited, a body of information so vast that we have been forced to specialize, lately, in education as well as in vocation. We no longer attempt, as we once did, to impart everything we know to every grown mind. We are content to establish in each a sense of the vastness and complexity of our culture together with certain of the more elementary principles of the applied sciences, and to trust to educational specialization for the equipping of the specially fitted mind to develop different fields of knowledge. Human minds are not capable of encompassing all the knowledge there is any more. We judge it sufficiently difficult to apprehend the knowledge of any one science; and we trust to some means of coördination to bring the applications of the sciences together. This field of coördination is one of our weakest spots and will have to have much more attention in the future than it has had in the past. But, taken in the large, we have come an immense way in a century or two in accumulating technique and in learning how to conserve it and pass it on.

These, then, are the means by which we protect our inheritance: by making and storing records and by the transmission of information through formal or informal education. It remains to discuss the means by which we make additions to our inheritance. Research is the general name which we give to this activity. It will be discussed in a later section.

It does not seem far-fetched, however, to attribute some part of our increased productivity to the cumulation of knowledge and skill in a body which grows greater and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greater and also, as it grows, becomes more and more accessible.[1]

3. *Changes in the size and pattern of our population.*

If we have been surprised by any social change more than by the shiftings of the pattern of population, it would be difficult to say what it is. Under the unseeing eyes of social theorists and without otherwise taking thought, we have completely rearranged ourselves. If the movement has been a blind one, it has been nevertheless very effective. It has changed all our ways of behaving, but most notably for us, of course, ways of producing goods.

To say that the new patterns of population have been one of the causes of the new productivity is perhaps to place the cart before the horse; and yet it is easy to see that one fashion of grouping may be better than another for purposes of making and distributing goods efficiently. Factories and transport facilities have doubtless drawn people to themselves, but once changes have been made, industrial functioning may have gone more smoothly. So it may not be incorrect, after all, to assign some causal importance to population changes. There is at least sufficient reason in it to make the suggestion worth while.[2]

The first thing to be said is that population has grown.

[1] The interested reader is here referred to the author's essay, "Experimental Economics," in the volume called *The Trend of Economics*, 1923.

[2] What information is readily available readers can find in *The Statistical Atlas of the United States*, published by the Bureau of the Census, 1924. But the information concerning actual population patterns is very meager. Some references to this problem will be found in "A Review of the Literature of Location of Industries," by Witold Krzyzanowski in the *Journal of Political Economy*, xxxv, 278, later cited in another connection.

Economists have for a long time entertained a proposition concerning population growth which may be stated thus: Up to a certain undetermined point, at least, every individual added to the working force makes a contribution which is greater than is required for his support. If we think solely of national productive efficiency, additions to the population are desirable up to this point. The question as to the location of this limit is for America pretty largely an academic one. We are a long way from it as yet. The rapid growth we have had must be said, on the whole, to have been highly favorable. Theoretically the limit of efficiency is set by the conjunction of three variables: Size of population, extent of resources, and the state of the industrial arts, including in this last the arts of transportation and communication. But no such equation can be worked out unless we can assign definite quantitative values to each variable. If we could do that, we could say how big we ought to grow.

This has been tried with most appalling success; that is to say, certain statisticians have worked out probable and desirable sizes, but always by making astonishingly naïve assumptions, the most questionable of which is, perhaps, that no future changes in the industrial arts will occur.[1] On the whole, we seem to be left just where we were in the beginning as a result of all this theoretical discussion, because no one has been able to say for certain what will happen in the future either with respect to control of birth or death rates, or to advances in industrial technique which will have the effect of raising

[1] One who is interested in the general problem of population will find discussions in such works as Harold Cox's *The Problem of Population*, 1923, and A. M. Carr-Saunders' *The Population Problem*, 1923. One ought to consult also some such corrective as J. R. Smith's *World's Food Resources* (last 100 pages).

the desirable limits of the population size. We can, however, see an amazing gain in productivity and a corollary increase in population. It is not altogether fair to infer that these are related, without some further reason for thinking so than that they happen to be simultaneous, but this conjunction of events does leave something to be explained by those persons who think that we have already grown too big.

A formidable weight of evidence supports the contention that there are still far too few of us to gain all the advantages there are in coöperative effort, but that we are rapidly growing toward a size which will maximize the results of our efforts. Attempts to analyze the situation are confused by the mutuality of adaptation between industrial processes and the groups who function in them. Doubtless we learn to work better with the groups at our disposal, but also the fact that society is adding to its numbers seems to make work easier for everyone and to enlarge the product from it. Each of these may be both cause and effect, but if the general results are to increase production so as to raise the levels of living generally, that is at least one important fact to which we can cling.

The growth in the size of population is, however, a very gross fact, which to have any meaning needs to be refined. For we have grown in definitely original ways. One way often remarked is that cities have grown at the expense of rural districts. Instead of being three-quarters rural, as we were in 1850, we are now considerably more than one-half urban. Urban for the census-makers means communities of more than 2,500, but by no means all others live on farms. Some 20,000,000 of us live in villages and hamlets ranging from a few souls to the 2,500, which the census-makers consider to be a city.

There remain only some 30,000,000 for the farms. Frequently in even small villages there are independent or branch industries of some little importance, which form an exception to the general fact of the urbanization of industry; but usually villages are suburban, places to live, rather than places to work. Such communities must, of course, be considered to be satellites of urban centers.

Some further light may be thrown on the problem by figures of occupational groups. The "gainfully employed" in the United States in 1925 are reported by the National Industrial Conference Board as being distributed as follows:

	Per cent
Manufacturing and mechanical	29.9
Agriculture	24.5
Trade	10.7
Clerical work	8.9
Domestic and personal service	8.4
Transportation	7.6
Professional service	5.5
Mining	2.7
Public service, including military and naval	1.8

The changes of recent years are interesting. There has, for instance, been a decline in the total number of gainfully employed of from 41.5 per cent in 1910 to 37.2 per cent in 1925. This in itself is significant of progress: it doubtless means more children in school rather than at work, for one thing. But other changes are even more interesting for the present purpose:

During the period mentioned the number engaged in agriculture has shown a decided decrease. In 1925 only 24.5 per cent were so employed in a gainful way, as against 33.2 per cent

in 1910. The proportion of those in the manufacturing and mechanical industries has increased only slightly, from 27.8 per cent in 1910 to 29.9 per cent in 1925. Clerical workers nearly doubled their proportion to other workers, constituting 4.6 per cent of the gainfully occupied in 1910 and 8.9 per cent in 1925. Those in trade, in public service or in professional service have slightly increased in proportion to other groups, but a relative decline from 9.9 per cent to 8.4 per cent is estimated to have taken place in the proportion of domestic and personal servants to the total number of gainfully employed.

These figures are not conclusive evidence that changes favorable to efficiency have taken place in population grouping; but they show that changes are taking place in a number of ways. They show very clearly, of course, the growth of city occupations and the decline of rural ones. In fact the most notable movement of population has been into the cities. Certain very obvious advantages for industry exist there, as was discovered, for instance, by investigators for the project known as the Regional Plan for New York and Its Environs. As Professor Haig says: "Managing and administering, buying and selling, financing and risk-bearing, investigating and advising—these are among the functions which find the city very congenial, indeed." [1]

In the articles in which Professor Haig analyzes the population patterns and the activities of urban regions, he was led first to the construction of a theoretical pattern for population and then to a consideration of the pattern as it actually exists. He found that one who should be set as a problem the devising of an ideal arrangement of population would find it set in the following terms:

[1] Robert M. Haig, Director, Economic and Industrial Survey, Regional Plan of New York and Its Environs, *Quarterly Journal of Economics*, xl, February and May, 1926.

In the search for an explanation of the present pattern of population with its great concentration of people in urban centers, it is illuminating first to consider abstractly what kind of a pattern would result if one were to plan deliberately a world for economic efficiency. . . . The designer would soon realize . . . that only a minor fraction of his available labor force is required to till the soil, to dig the minerals from the earth, and to perform the other types of primary extractive work, and that only another minor fraction is required to man the transportation system and to locate with reference to convenience in performing this function. Consequently a very large part of the population is economically "foot-free" in the sense that it is under no economic compulsion to live "on the land." Where shall the foot-free live? Some, indeed, are in possession of sufficient claims upon the product, without personally contributing toward current production, to enable them to refrain from work and to live wherever they feel they can get the most out of life. Location interests them only as it affects consumption. The great bulk of the population, however, must work and must consume most of what they earn where they earn it. With them consumption and production are practically a simultaneous process and must be carried on for the most part in the same place. To them location is of interest both in its effects upon production and in its effects upon consumption.

A study of possible sources of raw materials and the transportation problem involved in concentrating them at various points would reveal the potential urban sites. Such sites must meet certain requirements of climate, but climate, after all, is a matter of fairly broad zones. Within those zones transportation advantages would be, it is believed, the chief determining factors. As among various possible sites served by the same sources of raw materials, the choice will tend to fall in favor of those where it is possible most cheaply to lay down those materials which are destined to enter into the desired assortments of consumption goods. This suggests, then, that the kind of pattern which would give the greatest economic efficiency under the assumptions stated is one which makes maximum use of territorial specialization within the limits set by the available means of transportation. The most favored spots are those from which the richest resources can be tapped with the lowest

transportation costs. At such points would develop the great cities. Smaller urban centers would be expected to appear at less favorable points, to the extent that, in accordance with the law of diminishing returns, the degree of intensity of utilization raised costs and thus forced a resort to the poorer resources.

In the lower cost of supplying consumption goods at these convenient assembly points is found, then, a positive and, in the opinion of the writer, a very powerful force tending constantly toward the concentration of the entire "foot-free" population in urban areas. To justify locating a person elsewhere some advantage in production or in consumption must be obtainable sufficient to counterbalance this fundamental advantage of concentration.

As he goes on, Professor Haig is struck by the fact that such an ideal pattern is very much what we have at present.

The theoretical pattern . . . calls for the location of all business functions, except the extractive and transporting functions, at the concentration points in urban areas. So far as all the other functions, except certain types of fabrication are concerned, the theoretical pattern conforms closely to the actual pattern.

If this is true, there seems to be a powerful reason for believing that part, at least, of our sudden increase of productivity is to be accounted for by the accomplishment of a movement toward productive efficiency, which was until a few years ago too nearly uncompleted for its effects to be felt. It is still incomplete, probably, but we seem to have gone far enough to achieve many of its results. This problem, like many others we face, needs much more study; but enough has been discovered in a general way so that we can see immense possible gains to be got from such an analysis of population patterns as will give us guidance in the control being sought by social planners of all kinds, and most particularly by those of the great

centers such as New York, Chicago, and Philadelphia. If we can assume that the arrangement of population has something to do with productive efficiency we can, by intelligently guiding the arrangement of the population, increase the efficiency of production. If we seem to have accomplished something in this regard so far, it has not been because we planned it but because it merely happens so in this as in other social arrangements. We cannot always expect that so happy a result will eventuate from haphazard change. In order to secure our progress, we shall need to pursue our advantages very much more rationally than we have in the past.

4. *Progress toward the more complete division of labor and the consequent mechanization of industrial processes.*

Always provided that there is effective coördination, the division, among a number of individuals, of the different tasks required to make anything seems almost invariably to add something to each individual's efficiency and to make the whole task cheaper in money and less wasteful of effort. This division of tasks was one of the earliest developments of the industrial revolution, and has been one of the most persistent throughout the whole evolution of the industrial process. There is every evidence of this. It was on this note, for instance, that Adam Smith opened his discussion of the Wealth of Nations in 1776.[1] He used the pin-making industry for an illustration, but an observer cannot miss the same phenomenon in our more complicated modern industry, except, of course, that we have carried our division very much further. It extends now not only to the division of work

[1] Chap. I of the *Wealth of Nations* contains the familiar illustration from the pin-making industry, which is cited so frequently by economists even to-day.

among individuals who are coöperating to complete a single, simple task, but among groups who together create our machines, our buildings, and the rest of our profusion of finished products.

It goes even further than this. Whole regions of the world specialize in the making of some article or group of articles which go to make up our standard of living. This development would probably extend rather more rapidly than it has if political considerations did not interfere. The idea of nationalism with its concomitant high tariffs, is allowed to intervene and to prevent the normal processes of the localization of industry—which means the specialization of each region on what can best be accomplished there. The most notable illustration of this at the present time is the continent of Europe, where some dozen small national groups are scattered over a region which is naturally an economic unit—in the sense that each possesses something needed by the others. The principle of the self-determination of small nations has led to the dignifying of political sovereignty to the point where living standards are distinctly lowered by interferences with the normal functioning of trade and industry. Tariffs in Europe become very definitely taxes on consumers and account for a great part at least of the industrial backwardness of Europe as compared with the United States.[1]

[1] On this point readers are referred to *The Road to Prosperity*, 1927, by Sir George Paish, in which is discussed the 1926 manifesto of the international bankers, advocating a lowering of tariffs for Europe. This manifesto was called "A Plea for the Removal of Restrictions upon European Trade." It seems a powerful argument and, coming from the source it did, one which might have an effect on policy. So far, however, it has been ignored, not only abroad but by our own government. One striking paragraph follows. The whole manifesto was in this key:

The most fortunate region of the earth in this respect is the United States, because, more nearly than any other nation, we possess, within an area free from imposts and other trade interferences, all the materials of a complete economic life.[1] It is necessary to say "more nearly than any other nation" because important exceptions have to be noted even in our own case. Admitting our dependence on the tropics for such products as vegetable oils, sugar, fruit, and spices; on Mexico for petroleum; on Germany for chemicals; on Great Britain for rubber; and our necessity for importing many other important materials such as tin, manganese, chromium, wood pulp, shellac, sodium nitrate and the like, we are still in a position far superior to any other political unit in the world. There never has been, and there is not even now, any single political unit which possesses within its borders so many of the raw materials, power resources, and specialized industries as are to be found within the United States. One has only to think of our enormous crops of wheat, corn, cotton, dairy products, fruit, and wool, our many natural resources such as coal, iron, copper, timber, and other raw materials, our system of transport

"There can be no recovery in Europe till politicians in all territories, old and new, realize that trade is not war but a process of exchange, that in time of peace our neighbors are our customers, and that their prosperity is a condition of our own well-being. If we check their dealings their power to pay their debts diminishes, and their power to purchase our goods is reduced. Restricted imports involve restricted exports, and no nation can afford to lose its export trade. Dependent as we all are upon imports and exports, and upon the processes of international exchange, we cannot view without grave concern a policy which means the impoverishment of Europe.

[1] One reservation has to be made: freight differentials fixed by the Interstate Commerce Commission act as artificial restraints comparable to those of tariffs.

and communication, and the development of our factory system, to realize our superiority in this respect.

That coal, iron, timber, and all the numerous other materials which together make an automobile, an office building, a bridge, a dinner, or an overcoat, can flow freely together without being anywhere taxed or otherwise hampered in their movement, except by the necessary cost of transport, must be accounted one of the greatest advantages we enjoy. While the nations of Europe are wondering why we are progressing so much more rapidly than they, backed by their thousands of years of culture, they might find it of advantage to consider this element of our superiority—the easiest of all for them to duplicate when they can find the common will. Our moral supremacy in this matter cannot be stated with too superior an air, however, since it is a matter of luck rather than foresight which gives our industry this enormous advantage. So far as our attitude toward the free localization of industry is concerned, we are in no better position than Europe. We simply happen to have wider areas and a greater spread of resources. We traditionally maintain tariffs as high as, or higher than, other countries, and consider national self-sufficiency to be quite as worthy an object as any of the smaller nations of Europe. If the development of a necessary geographic division of labor has gone further in the United States than elsewhere, it is not because of any intention. It must, however, be put down as one of the elements of our marked superiority.

There are other ways also in which we have progressed more rapidly than other nations, which ought to be discussed under this general heading of "division of labor." One of these has been our willingness to intro-

duce machines whenever tasks became sufficiently routinized, and to go on insinuating them into every industrial process until that particular affair becomes entirely mechanical. Industry after industry has been transformed in the past twenty years in just this way, until, within whole industrial units, the mechanical series approaches completion. In the making of many things now, the only work of man is to design, to repair, and to lubricate, and even this last is frequently done mechanically. Indisputably, we have a general notion that work which machines can do is not a part of desirable human activity. We have achieved an attitude which, though by no means universal among us, is so much more widespread than in other places in the world, that it is frequently spoken of as one of our contributions to the new culture.[1]

An American coming for the first time into contact with European industry is astonished to find an employer there sometimes rated by the number of his employees instead of by the net product which his organization is able to turn out. The notion of an employer as a philanthropist because he makes work and provides jobs, is very nearly unknown among us any more. We have developed a fairly definite idea that an employer's business is to eliminate work. It might almost be said that

[1] For descriptions of this process of machine substitution, there are some few available sources. One is G. E. Barnett, *Chapters on Machinery and Labor*, 1926. An earlier one was a small study made by Charles Reitell, *Machinery and its Benefits to Labor in the Crude Iron and Steel Industries*, 1917. In the April, 1927, issue of the *Monthly Labor Review* of the Bureau of Labor Statistics, there is a description of the coming of machinery in the bottle-blowing trades. See also a description in *The New York Times* for July 23, 1927, of a new mechanized process for the manufacture of sheet steel. Such accounts as this last can frequently be discovered in journals and newspapers.

he is not an employer, but a manager (and this follows partly from divided labor as a principle) who puts together the elements of production in the most effective way; and this most effective way we have long since identified with routinization, the continuous process, the application of the power of machines and their development in series. If we have enormously increased man-hour productivity in the past few years, much of the credit must be allotted to the cumulation of series machinization. Jobs which were little by little adapted to power machines have gradually come to the point of development at which machines could be introduced into the very heart of the work, and finally could be linked together. The reduction in the number of men required to produce a given number of units of product would naturally be much greater in any later stage of this progress than in any earlier stage.

We ought not to overlook, in this matter also, our greatly superior designing; jobs which, by reason of complicated motions, or the difficult joining of processes, were a few years ago considered beyond the scope of machines, are rapidly being subjected to a mechanical plan. Part of this is because of our more intensive development of technical education, which gives us a greater number of better equipped mathematicians and designers, and part is because of the perfection of the equipment which we provide for their work. We are very rapidly evolving a theory of planning and designing as the heart of our industrial technique.

But it is not only within any one plant—even any one business organization—that the superiority of our conception of the division of tasks is to be discovered. Careful division of tasks without the development of corollary

coördination would be entirely futile. Of what use would it be to develop the modern automobile assembly line, for instance, if it were not made certain first that all the parts would be available as the machine being assembled moved past? The necessity for superior coördination imposed by the continuous process in industry has led to an immense development of paper-work for coördination within businesses. But not only within units of business themselves but among different businesses which have interrelations, this development has taken place. Steel goes into many products; so does timber, rubber, and glass. Paint covers nearly everything. Machinery must all be lubricated, and all the businesses which are devoted to making these things have inescapable overlappings which are recognized in numerous ways. Every movement for coördination makes each productive operation more effective, and the total result in the reduction of wasted effort and overequipment in industry is immense.

Much still remains to be done, but our progress is still a marvelous achievement if we consider all the barriers to it in the old conceptions of the privacy of business and the independence of industrial function. Generally, the idea grows that industry is a social function for the provision of goods, no part of which is separable from the whole. If more remains still to be done in this field than in most others, we have still to credit its developments with an appreciable part of our last few years' progress.

5. *Reduction of stoppages of and interferences with industrial activity which we group under the name of depression.* Twenty-five years ago there was scarcely one business man in a hundred who was familiar with the phrase "busi-

ness cycle," or, indeed, who recognized that there were rhythmic changes in industry which brought, in roughly regular course, prosperity, depression, recovery, and depression again. It was well enough known that occasional depressions, and even panics, occurred. The cataclysmic effects of panics were too serious to be entirely ignored. They were not thought of, however, as regularly recurring phenomena, but rather as disasters which occurred only at wide intervals, and then because of some great fundamental disturbance in the progression of normal affairs. That they followed anything like a regular course was entirely unrecognized.

The past few years have seen an immense gain in this respect. The idea of the economic rhythm is as familiar now to all business men as the often cited, but little understood, "law of supply and demand." This is a familiarity for which credit must chiefly be given to university research and scholarship, for it was among university scholars that the idea was developed and studied, and it spread only gradually to the business world. The bad effects of the depression phase of the cycle were so notable, however, that a readier audience was found for this product of university research than for most others, and the larger organizations of business with their greater need for forward planning and coördination soon found it profitable to develop studies of their own of the cycle, which have, by now, become fairly extensive; so that our knowledge of the phenomenon—especially in its market and financial phases—is progressing very rapidly.

The business cycle is not so simple a phenomenon as was once supposed. As study goes on, more and more industrial processes are discovered to be a part of the total

changes which take place. Movements of population, expansions and contractions of employment, changes in the money market, movements of the rates of interest, profits and wages—all occur apparently in some degree of correlation with the general cyclical movement. So also do shifts in the physical volume of production and fluctuations in price levels. Most economists now feel that the business cycle is to be understood not through any index of total business activity, but by movements among all the seemingly unrelated forces which function together in industrial life. This is felt primarily because an index of total productivity or of prices is an abstraction, which, for purposes of analysis, really hides more than it reveals.

It is only by the most minute research into the concurrent happenings throughout industry, as the cyclical movements begin and move through their generally regular course, that there can be any hope of the isolation of its causes. There is no competent authority at present who is ready to say very much about causes, because so much remains to be done in the way of gathering information and correlating apparently discrete movements. Naturally, therefore, very little is said about the control of the cycle.[1]

In spite of the meager knowledge we have of business cycles, an extensive literature has grown up which centers

[1] The best authority is Professor W. C. Mitchell, whose book, *Business Cycles*, in 1913, was the first systematic account of the phenomena we now associate with the cycle. The first volume of a revised account has recently been published as a part of a series by the National Bureau of Economic Research of which Professor Mitchell is director. This Bureau has done the most extensive work on the cycle. Its publications include *Business Cycles and Unemployment, Business Annals, Employment Hours and Earnings in Prosperity and Depression,* and others of a similar nature.

in suggestions for control, mostly concerned, naturally, with hypotheses to account for its occurrence. It will be sufficient to summarize these theories here: [1]

I. Physical causes.
  A. Jevons. Sun spots.
  B. Moore. Eight-year periods in the conjunction of Venus produce similar cycles in mundane weather, crop-yields, and business.
  C. Huntington. Weather cycles affect health which in turn affects business.

II. Psychological causes.
  A. Pigou. "Optimistic error and pessimistic error, when discovered, give birth to one another in an endless chain."

III. Institutional causes.
  A. Processes of business management.
    1. Hardy. Uncertainty gives rise to alternate over- and underproduction of goods.
    2. Veblen. Discrepancy between prospective profits and current capitalization.
  B. Processes of producing goods and of distributing and spending incomes.
    1. Hastings, Foster, and others. Incomes disbursed by business enterprises are alternately less and more than the full value of goods produced for sale.
    2. Socialists. Overproduction resulting from exploitation of workers who receive in wages less than they produce.
  C. Processes of consuming, saving, and investing capital in new construction.
    1. Hull. Relatively slight changes in the demand for consumers' goods and in costs of construction cause far more violent changes in the volume of construction work, which in turn react to heighten changes in demand for consumers' goods.

[1] From *American Economic Life*, p. 326.

2. Hobson. Large incomes, which grow rapidly in prosperity, lead to over-saving and over-investment in new plants so that supply exceeds current demand.

D. Processes of banking.

1. Hansen. Banks increase purchasing power of business men when prospects are favorable by lending credit; later they are compelled to restrict advances. In following crisis and depression idle funds accumulate in banks and enable them to start new expansion.
2. Fisher. Discount rates lag behind when prices rise, giving borrowers increased profits and stimulating activity. Shortage of reserves forces a rapid advance of discount rates which pass prices. Crisis and depression are precipitated. Increasing reserves and dull business finally reduce discount rates faster than prices are falling and so prepare for a resumption of activity.

All of these remain, however, unsubstantiated. They were not put forward usually as total explanations, and there is some degree of truth, very probably, in many of them; but our knowledge of the phenomena has increased so rapidly and has revealed so many and such intricately interwoven relationships as yet not fully explored that no single explanation in very simple terms is regarded any more as sufficient.

Nevertheless we seem to have made some considerable progress toward correcting the swings of the rhythm and toward smoothing out the fluctuations in activity which are its worst social manifestations. This may seem strange at first, in view of what has been said, but it will readily be understood that simple recognition of the rhythmic nature of business changes would be, in itself, a salutary influence. A business organization which has learned

from carefully charted experience, extending over a number of years, that it may expect a fairly regularly occurrence of hyper-activity and of depression, will not be nearly so vulnerable as it would be if it were totally ignorant of what might be expected. Every least bit of uncovered evidence and every item of publicity has, therefore, tended to increase a kind of general self-knowledge and preparedness for what may come, even though we are not ready to put a scientific finger on definitive causes.

The tendency of banks, and even of other business institutions, to depend more and more upon economists' analyses of current business has helped; and the extension of the business audience through trade journals, newspapers, and the so-called economic services has made all business men aware of the month-to-month progress of the cycle. Various attempts which have been made to predict the recurrence of its various phases have not had a success at all proportionate to the effort which has been spent on this kind of activity, but the predictions from various sources have engendered an enormous interest in the cycle and have tended to spread about the business world a knowledge of it which has had important effects. So-called "business barometers" must be said, on the whole, to be very nearly worthless so far as giving any assurance of what is to happen in the future is concerned, but they have had the important effect of making many people aware, who would otherwise be ignorant, of what is happening in the present.

If all business men knew when a depression was due, it simply would not happen, because of the preparation for it which would immediately occur. We have not reached any such point of prediction, nor of the spread of information as yet, but we seem to have gone suffi-

ciently far to obviate some of the worst features of too-intensive activity and of stagnation. Most of the credit for this must probably be given to the spread of current information, and to the general knowledge, which has been absorbed by the business public, that cycles are always in process, and that the wisest business policy is to be prepared at all times for the phase which may normally be expected to follow the present one, whatever that may be.

Among the other developments which have helped to mitigate the fluctuations of the cycle have been the superior elasticity of currency, which was achieved with the adoption of the new Federal Reserve System. Our present control of currency is apparently, if we may judge by the experience of the past few years, achieving a stability which is entirely unprecedented, and indexes for the movements of prices for the past few years show fewer fluctuations than for almost any period in our history. If this stability can be maintained, one of the worst features of the cycle will have been obviated. The Reserve System also, of course, achieves a certain measure of control of business activities, a rather rough and negative control, but nevertheless more than we ever had before the system came into operation. Through manipulation of the rediscount rate, the Federal Reserve System may steady industry's price levels as our old banking system could not do. Through the informal advice of the Federal Reserve personnel, banks and industries can be warned of too great expansion and prevented from entering such periods of feverish activity as would lead to disasters later on. Just how much of this work is carried on by the Federal Reserve Board, actually, no one can say,

because it is done informally and its results are, of course, never published. Open market operations have also developed extensively with similar generally stabilizing effects, but also with similar hidden direction so that it is often difficult to discern the precise results expected from them. On the whole external evidence would seem to indicate that there is a good deal of such covert controlling exercised at various strategic ganglia of our system at the present time.

Certain technological developments also have undoubtedly assisted in stabilizing the rhythm. It will be seen, for instance, that a reduction in the time required for the transit of raw materials to finished products would have the effect of reducing inventories, and would make business organizations, which, by necessity, usually have to carry heavy ones, much less vulnerable to price recessions. The most notable instance of this kind of thing is the recent development in the Ford industry of a twenty-four-hour process by which iron ore and coal are turned into running motors. Such startling developments are not possible in most industries, but once the problem and its conclusions are clearly seen, many businesses will contrive means to reduce the time required for the turning of materials into finished goods, and so eliminate one of the great risks which any large business organization has to carry.

Still another development in the business world which has had an important effect on cyclical movements is the unmeasured—but undoubtedly important—development of better coördination among different businesses and industries which makes for a better adjustment of business to business, and industry to industry, and reduces the likelihood of overdevelopment and failure

or stagnation. This is a purely voluntary process and has gone on entirely outside of government interferences. Many economists feel that it is one of the most significant controlling forces in the business world to-day and that it may be expected to have many important effects in the future in steadying business and therefore, of course, eliminating some of the worst features of the cycle.

Altogether most modern tendencies in business development seem to be rather the enemies than the friends of rapid shiftings in the rate of business activity. Added to this is an evident determination to discover its causes and the best means of its control. If, of recent years, the uncertainty of future activity has been somewhat reduced, that has been, for us, a favorable productive development, enabling us to go forward with much more confidence than we otherwise could. Here again, most of the gains remain still to be made; but we have, at least, accomplished something; and that something must be set down as one of the causes of our productivity.

6. *Our recent taking advantage of the possible productive contribution of women.*

Women are half the population. To leave them out of industry would reduce enormously the productive power of society. It is true that they never have been left out entirely, but there was a period in which but little use was made of their capabilities.

When the industrial revolution began and power machinery was introduced, it was soon discovered that women could tend machines as well as, or better than, men. They were, besides, more amenable to rigid discipline and less resistant to the long hours and extremely

bad working conditions which characterized the early factory system. Also, they would work for lower wages since they infrequently set as a standard a rate which would support a family. Taking all together, the situation of women in early English industry was an unfavorable one and remained so during most of the nineteenth century. There was the beginning of this kind of thing also in the United States, but conditions of women's work were never so bad as they were at first in England.

All during this century in the United States, women's work was mostly confined to the home, where they had a real function. In a rural economy, woman is the center of productive activities because the homestead is the place of work as well as the place of living. Women were, in this economy, the unofficial chairmen of the boards of directors of the going industrial concerns. Under woman's control, so long as American life remained rural, were all the productive activities which were carried on in the home, and these included most of the activities which involved the preparation of food, of clothing, even including the spinning and weaving of cloth, very often, and the making of soap, and always the provision of canned and dried fruits, vegetables and meats in their seasons, against the time when they would not be available. The woman was also usually consulted in the planning and carrying out of the work in the fields and stables, and in the marketing of the produce which resulted from these activities. She had entire charge of the education of the girls and of a great part of that of the boys of the family. The feminine stamp was impressed very deeply upon the rural culture of nineteenth-century America.

But with the economic shifts which resulted in work being taken away from the homestead and given over to the factories, and with the hegira to the city or town which took place late in that century and early in this, which modified extremely the size and importance of the home, much of the responsibility for providing the family living was shifted to the husband and father. Women were left with greatly reduced scope for their possible productive activities.

Where work is done in factories and is not participated in by woman, there is a great loss to society. For either she has little or no work to do, or, if she does work, her tasks may not offer any adequate scope for her ability. This last is probably the most serious feature of such a situation, for above all, the world needs to apply all the intelligence it can muster to the work of organizing the means of living. Until our present era, women were the traditional mistresses of this whole field; only the rough extractive and commercial activities were performed by men. A temporary failure of women to follow their traditional tasks into the factory transferred much of their work to men—who probably, on the whole, do them with less organizing ability and certainly with less finesse than would women.

With the growth of an economic surplus, there grew up a deadly tradition that women's place was in the home, and they, for a generation, came to be looked on more or less as decorative luxuries whose sole business was to have babies and to carry on the highly routinized and unintellectual tasks of restricted homekeeping, out of which pretty much all creative possibilities had been drained by the factories. But the very processes of industrial development which brought this about, when

they had gone further, brought about its decline. Cities grew, homes had fewer and fewer rooms, household tasks were more and more limited in scope. Girls began to have an education comparable with that of their brothers. They naturally found themselves restive under the compulsions and restrictions of the surviving rural tradition; and within the past few years women have shown more and more determination to find a place for themselves somewhere in the industrial system which will recreate for them a function more nearly suited to their capabilities than the restricted one to which they seemed to have been doomed by industrialism.

They are and will necessarily remain under a handicap imposed by the necessities of motherhood, but this handicap is very much less than is usually supposed; and is, as a matter of fact, continually reduced. For one thing, families are smaller. Our grandmothers, whose duty it was to provide some ten or twelve new citizens, could scarcely have taken any serious part in work which was carried on away from the home. It is, however, very different with women who are expected to have at most three or four children. Schools also have greatly reduced the restrictions imposed by motherhood, tending, as they do, to take partial or complete charge of children's waking hours from a very early age until maturity. There is also a discernible tendency to lessen the distances between places of living and places of work, so that women can more easily carry on the double activity of homekeeping and factory or office work. One reason for this is the growing problem of transit facilities in urban centers, which is forcing closer conjunction of places of residences and places of work. And another is the change in the physical aspect of factories which makes them somewhat more

desirable neighbors than they once were. In any case it makes jobs easier for women to find and hold.

Many of the new developments of industry have been favorable to the entry of women into productive work outside the home. A report recently issued by the Women's Bureau of the United States Department of Labor discusses some of the changing opportunities for the employment of women which result from industrial research:[1]

> The usual objective in applying the results of such research is to reduce costs, increase production, and create new products or forms of service. When the objective is achieved, the employment opportunities of men or women or both are affected.
>
> Among the applications of research which affect the employment of women are cited the utilization of hitherto dormant resources, the development of new raw materials, the invention of new products and new methods of communication, changes in method which reduce excessive labor and hazard and improve working conditions, "thus reducing the number of occupations from which women rightly are debarred because of the physical strain involved," the increase in transportation facilities, and the calculating and recording inventions and the new commercial inventions brought into existence to keep distribution and accounting abreast with expanding industry.
>
> As an instance of the development of new raw materials the report cites the discovery of how to produce from wood pulp, cotton waste, and other materials a viscose substance somewhat akin to the silkworm's secretions, and the further discovery of how to spin this substance into the fine filaments which are the basis of artificial silk, or rayon. This has not only created an entirely new industry peculiarly adapted to women, but has added a new field to the textile industry, in which women have always been employed. A somewhat similar development is found in the case of perfumes. "Within the past decade, chemical research has discovered how to extract and to build up the perfumes of a thousand blooms and the flavors of acres of or-

[1] This is Bulletin No. 50, 1926. The summary here is quoted from the *Monthly Labor Review*, xxii, No. 6, 80–1 (June, 1926).

chards from lumps of soft coal, which are but the residue of long dead forests and of millions upon millions of buried blooms." This industry is of such recent growth that the number and distribution of its workers is not known, but women are employed in it and it is known to be increasing rapidly in importance.

The effect of new inventions upon the field of women's employment is seen especially in the developments which followed the introduction of the typewriter, the telephone, and the radio. Not only are women employed in the actual operation of these to such an extent that typewriting and telephone operating are looked upon as distinctively feminine occupations, but they are largely employed in the manufacture of the various instruments used, and with each new application of electricity this field of their work increases. The substitution of one material for another often opens up new avenues for the employment of women. An instance of this is the growing use of aluminum ware in the household, which is a recent development; the lightness of aluminum makes it possible to employ women in its manufacture more extensively than was possible when heavier metals were used. In the glass industry, changes in methods and materials used have brought women into many occupations, and the use of the rare new minerals for the manufacture of small parts has opened up a new field for them.

One firm manufacturing tungsten and molybdenum products states that 70 per cent of its factory payroll is made up of women, who are employed on light assembling jobs and on light machines, such as riveting machines.

While pointing out that the field of possible developments of this kind is wide, the report calls attention to two important facts disclosed by the survey made:

(1) That the increased opportunities for the employment of women growing out of the foregoing developments in applied research do not necessarily increase the total number of women in industry and commerce beyond the growth occasioned by the growth in the adult woman population. An analysis of census figures indicates that the increased opportunities are resulting in a continued relief of the congestion of woman labor in the older so-called woman-employing industries, a relief started by the shortage of male labor during the war.

(2) That the wider distribution of women over the field of industry and commerce and their advancement into better occupations have not, on the whole, reduced the number nor impaired the quality of the employment opportunities of men, for neither men nor boys have taken the places in the old industries deserted by women. The numbers of both men and boy wage earners have increased more by the last population census. This fact should not convey the idea that occupations have not been shifted from men to women, from women to men, and from both to machines, as a result of applied research; it is only to show that the net increase in the number of women's employment opportunities resulting from applied research has not been accompanied by a net decrease in the employment opportunities for men.

The truth of what we have been saying may be illustrated best by a few figures. The percentage of employed women in the United States was actually slightly less at the census of 1920 than at that of 1910. There was, however, a reduction of only slightly over 1 per cent, the total per cent remaining about 20.5. This compares with about 30 per cent for England and Wales, 34 per cent for Germany, and 37 per cent (1911) for France.

But this by no means tells the whole story. A refinement of the statistics reveals a greater decline in the United States than in any other country of women engaged in agriculture, that is to say, from 22 per cent to 12 per cent of all gainfully employed, between 1910 and 1920.[1] In Germany, the decline in this period was only from 48 to 44 per cent. Figures for England and France for 1920 are lacking. In England, agricultural activities have long been practically closed to women, the percentage in 1911 being only about 2. In France, however, still mostly a rural nation as we were 50 years ago, the per-

[1] A change in the time of gathering the figures made this decline seem larger than it was, however.

centage is 48. In some other countries such as Italy, India, and Bulgaria, the percentage ranges from 60 to over 90.

Where have the women gone who have ceased to be employed in agriculture or in other similar occupations in the United States? The principal increase is to be found in a grouping called "public service and professions" where the percentage rose from 19 to 28 in the ten years between censuses. In this classification women now form nearly 41 per cent of all those who are employed. Those employed in factories dropped from 14 to 10 per cent of the whole between 1910 and 1920. These figures show among other things that women are not being forced into more and more routinized occupations, but are rapidly increasing in those occupations which offer them the greatest possibilities for the employment of their utmost capabilities.[1]

On the whole, such figures as these and such other observations as are open to anyone, seem to indicate very clearly a distinct gain in the status of women and a tendency to take more and more advantage of their capabilities in the higher ranges of employment. Some part of our new productivity must be because of these contributions made by women—contributions which have as yet by no means reached their limit.

7. *Better arrangement of our consuming lives which adds greatly to our productive power.*

One of the necessary conditions for the development of the large-scale industry which is necessary to lower per unit costs of production is a social habit of consump-

[1] These figures are quoted from an abstract in the *Monthly Labor Review*, vol. xxii, 6 (June, 1926), pp. 76 ff., of Woytinsky's *Die Welt in Zählen*, 1926.

tion attuned to the use of the kinds and quantities of goods which can be made in this way. If Americans had insisted on having individually tailored clothing, food prepared by hand from its raw state, houses all built on individual and different plans, and automobiles built to unique designs, they must have been restricted to many fewer of these things than they have had.

We have, however, shown ourselves individually willing to use goods essentially like—many times exactly like—the goods which other people have. We build from one design a million automobiles. Thousands of our pianos and radios are exact replicas of one another. Hundreds of our houses, especially apartment houses, are so nearly similar as to be almost indistinguishable; and when we consider the number of units of smaller things, such as articles of food, clothing, decoration or amusement, which are turned out on precisely the same model, we have a really staggering picture of standardized consumption and production.

This characteristic of our economy is frequently objected to by observers of the contemporary scene on æsthetic grounds. There cannot be so many people, they say, to whom standardized goods represent any expression of their own individuality. There would be no particular gain from arguing this point in social æsthetics here. An economist is on safer ground, anyway, if he is content to state the alternative as he sees it. Briefly, it is this: If we did not have a million automobiles made to a standard design by the cheap processes of large-scale production, most of us could not have them at all. They would be restricted, as they are now in Europe, to a very few who could pay the much higher price involved. At this point the objector usually says

that we should be better off without automobiles, and that may be—but most of us seem not to feel that way about it. Most workers' families, for instance, apparently feel that they are happier or somehow better off scouring the Sunday roads in Fords than spending the holiday as they otherwise would. But this is not the best illustration from the economists' point of view. The automobile comes too near, still, to falling into the classification of luxury. But when we say that only a few of us could have toothbrushes, safety razors, comfortable mattresses, canned tomatoes, modernized clothing and shoes, if we refused to take them in large quantities on standardized models, we are on much more certain ground. It is but a short step to the generalization that the maintenance of our American standard of living is conditioned on the use of the cheaply-produced goods of our large-volume processes.

There is plenty of evidence that this standard is the highest in the world, of course, if we mean by highest the greatest participation in the use of the goods generally known and desired by men. Comparisons of real wages at home and abroad show this clearly enough. Philadelphia, for instance, displays a real wage level more than twice as high as that of London, three times as high as that of Paris, and more than four times as high as those of Brussels, Rome, or Madrid. These capitals may be more picturesque than Philadelphia with her row on row of standardized two-story houses—Philadelphia has spread out instead of up because of the unlimited area of open country on all sides of her—but it may be doubted whether Philadelphians would willingly trade places with the citizens of any European city if they had to change their standards of living ac-

cordingly. The beauties of Europe belong to the past and they are sterile. If we are ugly, we belong distinctly to the present; and we are anything but sterile. We are going somewhere, if there be any virtue in that.

One of the less conspicuous dogmas of economists has always been that consumption directs production—that wants are somehow the initiating force in industry. This does not seem to be so true, any more, as it once may have been. Under more primitive systems of work, goods were made to order. They are now made almost altogether in anticipation of demand. The fact that we do make goods before we know how many of them will be used creates a risk for industry, which is one of its most serious problems at the present time. But the problem it creates is one which has to be solved in some other way than by going back to the earlier system of making goods only to order.

The familiar story of the visitor who was being shown through a soup factory is in point here. "Pretty soon," said the guide, "we will show you where the soup is made," pointing to the factory; "here is where we make the demand for it," throwing open the door of an advertising office. All of which suggests a new theory of motivation: that goods are merely instruments to the end of living, offering to the individual better or worse possibilities of adjustments to his world and solutions of his problems. It suggests that a selection is made among those goods which are currently available.

Consumption, then, in a modern sense is selective, not initiative or creative. Its influence on production is negative rather than positive. If people refuse a good, it cannot, in the long run, be made, of course. Or if they take it in smaller quantities it will be more costly than

it would be if they readily absorbed it in large quantities. But the initial guess as to the extent of use which will probably be made of anything is a responsibility which is borne by its prospective producers. On the whole, if we are to judge by gross results, they have proved to be fairly good guessers. We have been content to take cheaper goods even though they have been highly standardized, even monotonous, let us say.

It is wrong to suppose, however, that the exigencies of large-scale production allow no scope for the expression of individuality. Really, we have a much wider range of goods to choose from than social critics give us credit for. Our taking advantage of the economies of large-volume production does not mean that all of us inevitably have to live so that we fit a standardized consuming pattern. There are limits to the gaining of economies from increased size in industry. As the population increases, as its new arrangements make distributive functions easier, as transport facilities grow more efficient and cheaper, so enlarging the market-areas for goods, wider ranges of choice instead of more restricted ones result.

It is true that if a good is to be made cheaply, enough of us have to buy it to keep a large organization operating at maximum efficiency; but the more of us there are to whom it can be sold, the less each individual's compulsions to buy it are. There are enough of us to keep several large organizations operating. Instead of being restricted to one thing, we can choose among several. The very progress of population growth and of industrial technique which at first seems to lead to hopeless monotonies of consumption is thus seen to be the very development which frees us from them—and also, meanwhile, provides us with higher and higher levels of living.

All this development is under way at present. It has given us what, measured in the amounts of goods we use—and seem to like to use—is the highest standard the world has ever known. We could not have had it, however, if we had not been willing to adapt our consumption to the exigencies of modern production. Perhaps our sudden lifting out of a rural economy into an urban one, with the resulting disturbance in all our social relationships, has made us peculiarly amenable to the persuasions of advertising manufacturers, who were creating markets on a scale calculated to cut their per unit costs. At any rate, we have shown little resistance to the change; indeed, an enthusiasm for it, which prepared the way for and had a part in the making of our modern productive efficiency.

Any discussion of consumption, however, which overlooked our general failure to discriminate between what is honest and what is shoddy, what is worth our money and what is not, would be flying in the face of palpable facts. We have multiplied the kinds of goods too rapidly and made them, in their modern forms, too complex, for the ordinary intelligence to be able to discriminate among them. There is, consequent upon this, and upon the fact that there is more leeway in our modern standard for choices to be foolish as well as wise, a great mass of faked and misrepresented goods which are in every day use.[1]

[1] It is recommended that readers pursue the study of choice and spending further in Part III of *American Economic Life.* The simplicities of consumers which were barely mentioned here may safely be left to Messrs. Stuart Chase and F. J. Schlink whose *Your Money's Worth,* 1927, is a devastating critique of "contemporary buncombe" among the advertisers and which shows the present helplessness of the common run of consumers. Some remedial suggestions are made in the final chapters. An appraisal of advertising which is on the whole rather favorable, and some defenses of it

We are admittedly backward in the arts of spending money. And yet the larger fact still seems patent: that our general complaisance has favored greater efficiency in production.

8. *The development of combination and association among businesses.*

One who surveys the contemporary industrial scene in the United States will discover a number of different types of industrial organization. There still are to be found, in some kinds of industry, small-scale businesses which operate very much in the same way that businesses operated almost at the beginning of the nineteenth century. There are other businesses which have developed toward larger-scale operations, but which still dominate such a very small part of the particular line of trade in which they happen to be engaged that their advantages are confined exclusively to those which are obtained from the improvement in plant technology which accompanies larger scale, as contrasted with smaller scale, operations. Of these technical advantages we shall have a good deal more to say a little later on.

This development of large-scale plants is, however, not the most notable feature of present tendencies. This distinction would have to be reserved for what is sometimes called the combination movement. The forces operating behind the scene which brought about this development were different from those which brought

which Messrs. Chase and Schlink do not mention, will be found in three articles in the *American Economic Review*, xv, *Supplement*, pp. 5 ff., by Messrs. F. E. Clark, G. B. Hotchkiss, and W. D. Moriarty. A good deal of the characteristic argument for our orgiastic advertising campaigns is nothing short of comic in its eagerness to justify current practice; some remnant of respectability remains, however, which ought not to be overlooked.

about large-scale operations, but the two frequently overlap. The distinct economies inherent in combination are attributable to the savings made in the technique of general management as against plant management, and the superior coördinations which are made possible by the unifying of formerly competing groups of businesses.

This combination movement is usually described as having two general forms: vertical and horizontal. An outstanding example of horizontal combination which has recently come into being is the General Motors Corporation. A vertical combination might be represented by the United States Steel Corporation, or by the Ford Motor Company. The differences here are of considerable importance. The horizontal form simply brings into one organization a number of business groups which were formerly competing with each other but each of which might easily have advanced sufficiently far to have exploited the advantages of large-scale plant operation. Many times such a combination has been motivated by the desire to reduce competition and so control price. But there are, aside from this, distinct productive advantages which are gained even in this type of combination. Such a centrally managed group facilitates, by its very centralization, the spread throughout the industry of the latest technical improvements in processes and machines, makes possible the development of larger and more efficient research organizations, and tends distinctly to assist in the adjustment of supply to what is sometimes called normal demand. All of these are important, as we shall see.

The vertical combination has distinct contributions to make to industrial progress in all of the ways associated with horizontal combination, and in some others. It

might perhaps be more correctly described as the "integration of industry." This means, simply, that it brings under one control not only formerly competing plants but also the sources of their raw or semifinished materials; perhaps also the transportation facilities needed to move these materials from their original locations to where they are needed; and possibly the organization for the distribution of goods to consumers. Such an organization, if it is wisely managed, can adjust the flow of materials into its plants, and out of them into the hands of consumers, in as nearly perfect a fashion as our facilitating mechanisms are prepared to allow. As will be seen, it very nearly eliminates the clumsy middleman-marketing system which has to be depended upon by a series of unintegrated but necessarily coöperative business units. It takes up slack all through the system. It tightens the lines of communication.

Both horizontal and vertical combination movements have been going on very rapidly in recent years. Another somewhat similar, less formal kind of organization has, however, also supplemented it in various ways. What is meant is the very recent development of trade associations of all kinds, which have proved to be capable of performing many of the functions of the more formal combination.[1] They are frequently preliminary to the formation of horizontal combinations, but not necessarily

[1] For a definition of their legal status and some account of their activities consult Mr. Franklin D. Jones, *Trade Association Activities and the Law*, 1922. In volume xi of the *Proceedings* of the Academy of Political Science, will be found a series of addresses and discussions on the general subject of "Trade Associations and Business Combinations." Their legal status is defined by Messrs. George Roberts and William J. Donovan; especially, also, recent Supreme Court decisions bearing on them are analyzed by Mr. G. H. Montague. There follows a discussion of their economic significance.

so. As a matter of fact, in very nearly every line of trade which has failed to develop distinct and widespread combinations, these trade associations exist at the present time. They are variously called Associations, Institutes, Committees, and the like, but their purposes are always similar. They exist really for the exchange of trade information, and they could not have developed until there came to be a clear notion among business men that more was to be gained by each knowing the others' affairs than was to be gained by the old-fashioned trade secrecy. They differ in their extent and purposes somewhat, but not notably. They form a convenient mechanism for exchanging information as to progress in technique of all kinds, whether it has to do with trade processes, new machines, marketing or transportation facilities, the results of research, or administration of personnel. The whole effect is to spread throughout industry very quickly knowledge of the latest processes and to bring each unit or business in the trade more rapidly up to the standard of the best.

The general influence of this whole movement toward combination and association among businesses is to facilitate voluntary coördinations amongst the various groups which carry on the functions of our system, an influence which on the whole is extremely important. It tends to set better standards, and to minimize the possibility that certain groups may fall distinctly behind and form soft spots in which the development of technique is backward and production costs accordingly high. It insures rapid advances throughout the industry in all its technological aspects. This is important. But perhaps even more important is its general effect on the regularization of the necessary mutual adjustment between supply and demand.

Two of the great outstanding drawbacks to industry even yet are to be found in the overcapacity of our industrial equipment in certain lines, and in the piling up of stocks of certain commodities which cannot be sold. This comes generally from the uncontrolled allocation to certain industries of capital, and from the lack of any knowledge of how much of particular goods ought, in a current state of market, to be produced. We have gone almost entirely over to a system of producing in anticipation of demand, rather than production to order. The ultimate consumer expects to step into a store and find there whatever goods he happens to want. Even the manufacturer of finished materials in uncombined industries expects to be able to buy at spot the raw or semi-finished materials he needs. All this furnishes an element of considerable risk in our system which must be borne by someone. We have characteristically been content to let it be carried by a class of professional speculators, but that this way of doing is unsatisfactory is apparent from the most casual observation. Almost every large industry in the United States is overequipped and could turn out more products than it does. And there are very frequent shortages and surpluses of goods which are caused by something else than the alternating of niggardliness or generosity in nature.

It will never be possible to regularize entirely the annual contributions of nature to production. Crops will always be smaller one year and larger another; and this element of risk will therefore remain; but a better coördination of the various units of industry would have a very salutory effect in cutting down the periodic over- and under-supplies of finished consumer's goods, which are so costly at present.

9. *The cumulative nature of surplus, of which we have more than was possessed by any other economy.*

Surplus is what a society has which is more than its standard of necessity. Such a bare statement gains meaning when we add that what any age possesses quickly translates itself into a standard of necessity so that what seemed like surplus seems so no longer. We think we have to have everything we ordinarily use, but if the present is tested by the standards of the past and if what we now have is measured by what in the past has been considered necessary, we discover how much better off we are than ordinary folk have ever been before. When we do this it no longer seems exaggerated to call our own "an age of surplus." For, obviously, mankind struggled along through a considerable career with hardly any of the modern goods we now regard as everyday necessities.

The medieval peasant who subsisted on black sour bread and thin, root-vegetable soup for at least nine months in the year; who wrapped his body in coarse woolen rags and his feet in straw; whose house was a hovel with floors of dirt; whose bed was a bundle of rushes—this peasant who was as well off as common men had ever been before him—would have no trouble in recognizing ours as an age of surplus. Bathtubs, soap, toothbrushes, underwear, sugar, printed matter, canned vegetables, cold-storage meat, steam heat, automobiles, and movies would, it has often been remarked, have seemed items of an entirely visionary Utopia to the richest barons of that time. We need not go so far back as medieval times for a contrast either. The recent character of all the commonplace goods of our time is astonishing when the facts are investigated. Only one

generation needs to pass in order to have it forgotten that newly introduced goods were not always available. A little reading in the history of common men, or even a contrast with the backward regions of our time, goes further to create a vivid definition of surplus than can be got in any other way. So we are surprised to find that our grandmothers thought the newly introduced tomato was poisonous (as they did); and to discover further that it is so regarded in China to-day. The electric light is about 30 years old, yet some are astonished to learn that the Standard Oil Company has a candle plant in China with a capacity of many millions a month. This same company, by the way, has given away a good many millions of kerosene lamps in China in the attempt to sell its product. How many could it give away in the United States?

Tomatoes and electric lights are comparatively unimportant in the whole standard of living; but if we were to go through the whole list from artificial silk—of which about 50 million pounds are made annually in the United States—to granulated sugar, of which we use upwards of 125 pounds per capita a year, we should discover that nearly every item is new, if not in our generation, then new in our grandparents' time. Frequently, also those which seem old to the present generation have been improved out of all recognition—the telephone, the sewing machine, canned foods, or shoes, for instance.

But the most interesting thing is not that so many and such improved goods are made, but that they are made in such quantities and so cheaply as to be very widely available. We have not yet got to the point where everyone can share in all the kinds of goods there are; but we come closer and closer to it because of the

cumulative nature of these surpluses of ours.[1] What is meant here is not that we do not lose the arts of making these things, or even that we learn to make them progressively better and cheaper, but that just the fact of having them makes it possible for us to have more and more. For what becomes of them? People use them. And since they are better for their use it is inevitable that their improved energy, morale, and resourcefulness should result in new varieties and increased quantities. To make a contrast again, think how much better productively a nation's workers are for having good shoes instead of wrapped straw upon their feet, for sleeping in comfortable beds instead of on a mat of rushes, for being warm instead of half-frozen through the winter, for having a diet of wheat, corn, meat, vegetables, fruit, sugar, and milk, rather than one of sour bread and greasy soup (and never enough of that), for

[1] The deep difference in attitude between those who wish for wide (if wise) use of economic goods, for an expansion of consumption in the interest of a growing racial achievement, and those who think mostly of the conservation of our capital resources must be obvious. The one asks for generous, even extravagant, use of goods; the other asks for thrift, repression, abstinence—all the virtues of primitive life! Mr. G. A. Kleene in an article called "Productive Apparatus and the Capitalist" in *The Journal of Political Economy*, xxxi, pp. 1–20 (February, 1923), examines the change in our productive apparatus and in the means of capital growth. He concludes: "Whatever may be the future course of things, the time has come to alter somewhat the picture of the creation and maintenance of productive apparatus presented in our economic manuals. Abstinence and waiting are not essentials of every conceivable efficient economic society." But he thinks that with no more controls than we have at present the powerful industrialists will continue to force the growth of capital by robbing the poor of it. He argues for a control which would envisage capital needs and secure its growth from the real sources of surplus, leaving the access to goods, by those whose uses are now restricted, freer and freer.

having a bath every day instead of a few in summer only, for going abroad on concrete highways in a motor car instead of being confined to a dark little medieval town, with streets deep in mud and slush, without lights or sewers or water.[1] When we take a really good look at the difficulties the human race has survived we have good reason to be optimistic about a future created out of present possibilities.

Surplus of the sort represented by the ordinary commodities of general use has given industrialized peoples greater health, longer usefulness, and increased energy. It was to be expected that these gains would somehow translate themselves into increased productivity. But also to the fact that we have a surplus above what even we consider necessities we owe the modern institutions we have been discussing. Ancient Greece in certain favored spots accumulated enough of it to free a few philosophers, poets, and artists from grubbing in the soil; so did Italy at the time of the Renaissance; and in medieval times there could be enough of it diverted (largely by taxing interregional commerce) to build the great cathedrals. But never before our time were there the immense free funds we have developed in America, sufficient to provide our extraordinary educational program with schools, to cover the nation with railways and concrete roads and provide 25 millions of motor cars to run

[1] Here again it is not intended to overlook the difficulties to which Messrs. Chase and Schlink so forcefully call attention in *Your Money's Worth*. Shoddiness, faking, inflated salesmanship, unwise spending, overcharging, adulteration, which are items in their indictment, unquestionably exist. It is a genuine service to have redirected public attention to them. But would it be altogether untrue to call these the unpleasant scum on an otherwise nourishing industrial brew—a scum which may, when we are sufficiently offended, be lifted off and cast out?

on them, to give New York City two hundred theaters. The list may be extended at will to include the things one holds of most worth in life. They will be found, these best things in our culture, to be directly traceable to the funds of surplus we have built. And not least of all, aside from all the æsthetic and pleasurable aspects of our life, surplus has rebuilt our industry in good part, so that it begins, here and there, to take on an aspect of almost Utopian conditions of work. One should not have to defend this statement. It seems obvious that our really modern places of work are far in advance, as working places, of those which men worked in fifty years ago. If there is monotony and routinization, which must be admitted, there is light and air, and there are shorter hours, even a shorter week. Besides, as many believe, routinization will prove, in time, self-eliminating just because it can be machinized. At any rate, even the most captious critic will admit that surplus turned back into industry results in more and more goods.

Surplus is a factor, certainly, in our great productive advance. It underlies the rest of our progress. We used to say that money breeds money; we mean the same thing when we say that surplus breeds surplus.

CHAPTER IV

DISCUSSION OF SUGGESTIONS TO ACCOUNT FOR OUR INCREASED PRODUCTIVITY: TECHNICAL CAUSES

1. *The discovery and spread of scientific management and the elimination of rule-of-thumb.*

Scientific management became a name and a slogan in November, 1910, when Mr. Louis D. Brandeis, who was opposing a proposed advance in railroad rates, claimed publicly that the roads could, without raising rates, increase wages if they would make a genuine effort toward greater efficiency and reduced costs. He called the system which could accomplish this "scientific management." Before this time there was nothing generally known by this title. The actual processes which Mr. Brandeis had in mind had, however, been in process of elaboration and experimentation for some thirty years, notably by Frederick W. Taylor and his collaborators. But there had been no systematic formulations of principle which included the new devices for more efficient work. Even the basic ideas of efficiency were familiar to very few persons.

Nor was this ignorance merely one of words. When the phrase had been invented it carried no meaning. The essentials of the practice involved had been, it is true, presented to an inner circle of technicians in papers read before the American Society of Mechanical Engineers, and there had been some public notice of the results

achieved by industrial engineers on the Santa Fé Railroad; but there was not, in 1910, as there came to be later, a widespread popular acquaintance with either principles or results.

When Mr. Brandeis became convinced of the intrinsic merit of the new discoveries of the engineers, he resolved to propose their adoption as a solution for the dilemma of the railroads, caught between urgent demands for higher wages and governmental limits for rates. He planned to place on the witness stand ten of the leading men in the new movement; and it naturally seemed desirable that a common nomenclature should be adopted so that the same things should always be called by the same name. It seemed equally necessary that a single term should be found which would characterize the system as a whole. He called a conference which was attended by Messrs. Gantt, Gilbreth, and other engineers prominent in the new movement; and it was there agreed that the term "scientific management" should officially designate the whole system of devices and processes which made up the efficiency movement.

It was the rate-hearings contest, held subsequently, between the railroads and the shippers before the Interstate Commerce Commission which brought the new movement so prominently into public notice. Mr. Harrington Emerson, for instance, testified that the roads might save some million dollars a day if they would adopt the new system. This startled the public into genuine interest. Mr. Brandeis himself submitted a long and masterly brief devoted mostly to the analysis of managerial efficiency. The effect of the injection of scientific management into the rate hearings was felt almost instantaneously by the whole country. The periodical press, popular as

well as technical, was filled with explanations and surmises as to the potentialities of the new system. By the fall of 1911 Dartmouth College had arranged for a conference concerning its merits. In March, 1912, an efficiency society was organized in New York City for the specific purpose of applying the new principles in every department of production. Later the Taylor Society of New York became, in a very real sense, the focus of the movement; it still remains that, in fact. But since that time scores of other societies have been formed and most institutions of learning have introduced into their curricula the study of management and of efficiency as disciplines in their own right. So much study and attention must necessarily have produced profound changes in industry, though those changes would be expected, of course, to have escaped very soon from the categories of the pioneers in the movement.

We have already seen what scientific management is by referring to the "principles" which were stated by its discoverer Frederick W. Taylor, and by Harrington Emerson and others.[1] It gradually gained adherents

[1] A short account of the movement may be found in "A Critical Analysis of Scientific Management," by H. H. Farquhar in the *Bulletin of the Taylor Society*, ix, pp. 16 ff. (February, 1924). An even better short historical account is that of R. H. Lansburgh, "The Management Movement," in *Bulletin of the Taylor Society*, viii, pp. 46 ff. (April, 1923). Mr. Lansburgh sketches Taylor's relation to the movement, the vicissitudes it has undergone and the successes it has had. He also outines the sounder basis in practice prevailing in recent years. Mr. Lansburgh is also the author of *Industrial Management*, which is a standard text in this field. Perhaps no better way exists, however, of understanding the progress and diffusion of the movement than in tracing it through the files of the *Bulletin of the Taylor Society*, which has been hospitable to suggestions, from every source, for increased efficiency and which has recorded the chief successes and failures of the great variety of experiments in recent years.

during the early years of the movement, and experiments with its possibilities were made in a considerable number of operating organizations. In spite, however, of the undoubted benefits which it conferred in increasing output, reducing costs, and generally bringing order into industry wherever it was applied, it came only slowly into general use and as a definite, well-defined body of principles failed to capture industry as a whole.

This failure may seem curious in view of the admitted and obvious gains to be made by its use; and still more curious in view of the recent gains in productivity to which we have referred here. There are a number of explanations. For one thing it was bitterly opposed by organized labor almost from the first. There were good grounds for this, for frequently employers used it simply as a device for getting more work done at the same wages; and workers, since they were actively involved and necessarily had to coöperate if it were to succeed, thought they ought to share in the benefits. Early management experts neglected this psychological phase of their problem, and very often it ruined the success of the whole scheme. For another thing the new profession was taken up by many untrained and poorly equipped practitioners. Where they operated and failed, there remained a long and stubborn prejudice against anything savoring of efficiency. The pioneers erred also in conceiving the new practices as a fixed and rigid body of principles to be put into operation totally or not at all; and many managers resented the necessity for handing over to outsiders the whole system of affairs for which they had hitherto been responsible. Gradually, of course, as was inevitable, the charlatans disappeared, workers came to see the possibilities of increased wages if they could control the new

devices, and the movement itself ceased to be a rigid and monopolized body of doctrine which could be applied successfully only by a few original experts. It was broken up and diffused into a general body of knowledge and a new method of attacking problems. Science in management is not now the application, complete, of Taylor's or anyone else's principles; it is the study of local situations by experts and the devising of the best means to the end of production.

Taylorism served its purpose, however, in the same sense that Darwinism did. Study of the evolution of life soon outgrew any of Darwin's accounts of the means by which it took place; and intelligent management similarly outgrew Taylor's theories. We no longer call it "scientific management" usually. That term can now be seen to have been something of a misnomer. What was needed most, and what industrialists accepted after a normal period of hesitation, was the idea Taylor had that intelligence could always modify existing practice and improve upon it. By genuinely careful study, such as a laboratory scientist would employ, by exact measurement, analysis, and comparison, in a field where rule-of-thumb had been the accepted guide, and what men had traditionally done was considered to be the best, or, at least, the only possible thing, much could be done, as has been proved again and again. The idea that it could was genuinely revolutionary. Taylor himself was something of a genius in inventing devices for measurement and analysis—was, perhaps, the greatest management expert we have yet had.[1]

[1] A life, called *Frederick W. Taylor, Father of Scientific Management* (New York, 1923), has been written by Frank Barkley Copley. Readers will find in it a capable account of one of the great geniuses

But the attempt to confine his procedure to a set of principles was as great a mistake as Darwin's theories of natural selection have proved to be. Once the ferment had begun, however, once the method borrowed from the laboratory scientists had been established, engineers anywhere might use it as they chose. That is what happened. And this is why it is true to say that although scientific management failed to capture industry as it was expected to do, science in management is just now getting a real foothold. Its achievements are, most of them, still to come.

Concerning the productivity of the completer system of scientific management, where it was put into use, Taylor reported, for instance, that he never failed to find men who would unload coal from a car at the rate of forty tons per day instead of the usual fifteen.[1] Even before auxiliary features were developed, production on jobs in the Midvale Steel Works (where Taylor did his early experimenting) was increased 100 per cent. Mr. David Schloss also reported that piecework production could

of our time. The February, 1925, issue of the *Bulletin of the Taylor Society* was devoted to reviews of this book and appreciations of Taylor's work by Irving Fisher, Ordway Tead, Stuart Chase, Oliver Sheldon, E. E. Hunt, R. A. Feiss, and others. An excellent way to get the sense of Taylor's influence and contribution is to read these estimates of him. Two collections of authoritative articles on scientific management have been made, an early one by C. Bertram Thompson and a more recent one by E. E. Hunt (1924).

[1] *Transactions of the American Society of Mechanical Engineers*, xvi, p. 878. "Time-study," which accomplished this result, is becoming almost a science in itself. There is even talk of its standardization. See, for instance, "Standardizing Time-Study Data," by A. M. Lindsley, in *Industrial Management*, January, 1927, pp. 33 ff. See also *Time and Motion Study* by S. M. Lowry, H. B. Maynard and G. J. Stagemerten, 1927, a recent text which explores the subject thoroughly.

be increased from 30 to 50 per cent.[1] Also it may be noted that specific cases of savings and increased productivity per man are numerous.[2] In the case of the Watertown Arsenal, General Crozier in his report admitted "a remarkable saving in both time and money" following the introduction of scientific management. The Tabor Manufacturing Company increased its product two and a half times and improved the quality, following the introduction of scientific management, and this in the face of the fact that the number of employees had been reduced. The productivity of the Link Belt plant was doubled. In the cotton-spinning industry, productivity in scientifically managed plants increased enough to cover an advance of real wages running from 30 per cent upwards. The Ferracute Machine Company attained a new productivity amounting to 213 per cent of the old. Yard shovelers at Bethlehem increased their output 368 per cent. Savings on the Santa Fé Railroad were $1,250,000 in one year.

So far as specific cases go, it would appear that scientific management has contributed enormously to increased productivity. Judged by the test of measuring material outputs before and after the introduction of the system, the cases cited above, and others, show a definite correlation between the introduction of the system and increased productivity. Beside the fact of increased productivity in countless individual plants, which is a thing which can be verified from experience, there are certain broad general conclusions which can be made, but which cannot be supported statistically.

[1] *Ibid.*, p. 32.

[2] *Transactions of the Amer. Society of Mechanical Engineers, passim,* as well as other journals devoted to engineering practice.

These are, in general, that the diffusion of the original ideas and practices incorporated in the system have afforded a goal and a stimulus to industry which must be credited with a large, but unmeasured part of the gains of recent years. In spite of any reservations which might be made it has always to be remembered that the essentials of the efficiency movement, so far as it concerns technology alone, trace directly back to Taylor.

If there is one part of the whole development which is more important than another it is time-and-motion study. What has been added to this is the fact that this study is not a preliminary, ultimately, to better work by men, but to the introduction of machines. But the analysis comes first as an idea and as a necessary fact. The processes of time-and-motion study, important as they are and underlying as they do the whole achievement of recent years, are too technical for analysis here. The interested reader can be referred to the literature of the management movement.[1]

Really, in discussing improvements in technique of

[1] In Frederick W. Taylor's *Shop Management*, 1911, beginning on page 148, there is what may be called the original discussion. He describes how, while he was a foreman in the machine shop of the Midvale Steel Company, it occurred to him first that stop-watch practices might be developed. It was then, and for some time, only done to fix piece-rate wages. But gradually the idea grew that here was a fundamental means to greater productivity. H. B. Drury in *Scientific Management*, 1915, indicates that *elementary rate-fixing* came to be displaced by the more suggestive *elementary time-study* (pp. 77 ff.). The interested reader will find discussions of time-and-motion study in management periodicals, many of which have been cited here, and in many books on management and the efficiency movement. A recent article, for instance, is that of M. L. Cooke, "Morale as a factor in time-study technique," *Bulletin of the Taylor Society*, xiii, 331 ff. (April, 1927).

any kind, as well as such specific original practices as time-and-motion study, which we shall be doing in the pages which follow, we are developing the idea that intelligence in contrivance, accuracy in measurement and willingness in adaptation can make for greater productivity. And this is the central notion of "scientific management." If it has outgrown its original confines, that does not detract from the value of its first formulation as showing the way to advance. In a sense, the technical causes of increased productivity are scientific management. Many engineers would contend that this is so. About this it is useless to quibble, although it is perhaps better to insist that it is the accommodative and contriving ingenuity of experts which counts most in progress, not adherence to any conceptual system such as Taylorism tends to be.

2. *Directed industrial research and controlled invention.*

Very few people, even generally well informed ones, realize the extent to which the development of research has gone, particularly in the service of industry. Research itself is only an extension of the common sense which did very well so long as the problems faced by industrialists remained simple, but which falters when confronted with such problems as present themselves in the attempt to go forward from the advanced stage of knowledge which we have already reached.

Of research there is more than one kind. In general it may be divided into what might be called "free" and what might be called "directed." Free research is the sort which follows from the individual perception of a problem and an individual attempt to solve it with what-

ever means are at hand. Directed research is carried on to obtain specific results which are wanted for a practical purpose.

The development of research in general has gone on all through our social system; but has been most fruitful in advancing the realm of knowledge in universities first, and later in corporation laboratories. In both of these instances there has been some free and some directed work. But, as would be expected, the universities have provided the greater facilities for individual work. And it is there that most of the discoveries in "pure science" have been made. One needs only to mention the names of Gibbs, Millikan, Pupin, Morgan, Banting, and others like them to realize the worth of contributions from this source. And yet the names of Steinmetz and Coolidge, among the greatest individual discoverers, are associated with only one of our industrial laboratories. Others would furnish names but slightly less distinguished.

It is easy to see why research becomes a part of the lifeblood of large-scale industry. Technical problems arise nowadays which no one but the carefully trained man of science can hope to solve. The electrical industry finds itself dependent upon carrying forward the analysis of light and of gases, for instance. The modern gas-filled, tungsten-filament electric bulb was a product of such laboratory work. The radio could not have been invented without the research which developed the vacuum tube. Metallurgical research discovered the aluminum automobile piston. There are a thousand discoveries in every industry, known only to those familiar with its practice, which have changed its processes more or less basically and which have enabled it to go forward. And it is not

difficult to understand, therefore, the esteem in which such research is held.[1]

Characteristically, research is carried on in the great industries by an almost separate, non-profit organization with a budget furnished by the business of which it is a part. Its problems are set partly by the exigencies of the business, partly by the perceptions of the directors of research. The organization is kept sufficiently flexible to meet new problems which arise, but usually plans a long time ahead for most of its work. For a good deal of what must be done requires a coöperative setting forward of the boundaries of knowledge in a number of directions at once. Think, for instance, of the problems which must have been met by the scientists of the Bell Telephone laboratories in developing the wireless telephone from New York to London, which goes into commercial use, as it happens, on the day these lines are written!

Research is not all in the natural sciences either. The social sciences are beginning a like development both under university and corporate auspices. The technique of management, budgetary control, marketing adjustments, business analysis and forecasting, cost accounting, wage-rate setting, and a hundred other more or less specific

[1] For the best discussion of the problems barely suggested here see "Industrial Invention: Heroic or Systematic," by Ralph C. Epstein in the *Quarterly Journal of Economics*, xl, pp. 232 ff. (February, 1926). The cumulative nature of discovery and our newly organized technique for intensifying the rate of progress are there developed. The conclusion is that "deliberate inventions bulk very large in the aggregate." W. F. Ogburn's *Social Change* also explores the problem of deliberate or heroic invention with the weight of evidence falling on the deliberate side. There is adduced, for instance, a table of some two hundred major contributions to knowledge which were made by two or more inventors independently, seeming to show that when a certain point in cultural advance has been reached further inventions become inevitable.

problems await the development which can only come through the same sort of work which developed the Orthophonic Victrola or the Pontiac motor car.[1] Much is being done, but the results have not, so far, been so impressive in this field as in the other. Yet in both, the distance traveled in every year is much longer than that of the year before. Here as elsewhere results cumulate, progress multiplies itself. One of the coördinate causes of productivity is certainly to be discovered in these various forms of research.[2]

This may be given a certain definiteness by turning back to the table of 100 cases of technical advance which was cited some pages back. Most of these improvements —or many of them, at any rate—were the result of the setting of a problem and its solution by research. Study of them will also open to the imagination the possibilities which still lie ahead of us in widening knowledge and in improving on our current practice. Progress is steady in this direction, however. Continually our university facilities are enlarged, new foundations such as the Rockefeller and Sage Foundations are begun and the work of the old ones continued. The National Bureau of Economic Research and the Institute of Economics con-

[1] A discussion of management and research will be found in *The Bulletin of the Taylor Society*, xi, pp. 261 ff. in articles by H. S. Person, Mary Van Kleeck, and R. L. Tweedy. The first two discuss method, the last describes "an organization of Massachusetts manufacturing plants which enjoys the benefits of joint investigation of common managerial problems."

[2] For further discussion of the fascinating problems and methods of research, referred to in such brief form here, the reader is referred to *Profitable Science in Industry* by Farnham, Hall, Howe, and King, 1926. Various scientific journals are also available as well as journals published from the industrial laboratories themselves, such, for instance, as the *Bell Laboratories Record*.

tinually enlarge their scope. Industry after industry establishes basic study in natural and social science; and, not by any means least, the work of government agencies develops. Indeed the research carried on by the various departments of the government makes it the greatest agency of its kind in the world. In the current report of the Secretary of Commerce, for instance, there are listed some examples of these efforts in that department; it ranges all the way from experimentation on the production of crystalline levulose to improvement in aërial mapping; from a study of the properties of Guayule rubber to eye-protective glass. Work is also being done on radio waves, metallurgy, and strength of brickwork. This department is only one of many. In the figures we have already cited above showing the increased man-hour productivity of industry is to be found a single illustration of the work of the Bureau of Labor Statistics. The Department of Agriculture also supports extensive activity in many fields of biology and farm economics. Just recently the greatest single development has been the formation of a committee for the Enlarged Endowment of Pure Research through the National Academy of Sciences with the professed intention of securing a fund of from 10 to 20 millions of dollars to be expended over a period of years mainly through universities. All these developments cannot take place without profoundly changing industrial practice in the direction of increasing efficiency.[1]

3. *Standardization of many basic materials and processes.*

Another movement, sponsored mainly by the Department of Commerce, which has had a similar effect, is

[1] For an account of foreign experience, which also includes comment on American practice, see *Research in Industry*, by A. P. M. Fleming and J. G. Pearce, London, 1922.

what is usually called "simplified practice." Sooner or later, in an industrial system coming to maturity, something in the nature of simplification in numbers of designs and processes was bound to happen. In a highly competitive and small-scale system the success of an entrepreneur might depend upon small differences in the design of the product or upon indigenous gains made in efficiency. As industry increases in scale, widens its market and brings many formerly competing units under a single control, much of the pressure for slight differences in design is relieved; in fact slight variations become a nuisance, for often they represent no difference in the quality of service rendered by them and only make replacements or additions to equipment difficult. The kind of local technical changes which were necessary to small-scale entrepreneur business also becomes transmuted in character when industry grows to maturity, for though there may still be small gains in efficiency which occur as a result of suggestions made in the plant and on the job, many more of them originate in designing rooms as a result of engineering ingenuity. Indeed in a highly developed industry where the continuous process has a good foothold, it is only in the planning rooms that significant advances can be made at all, because a change anywhere requires correlative changes in other places which might upset the whole production program. Everything has to be planned with due regard to everything else. In such a situation as this, standardization is obviously of enormous benefit.

A good illustration of the gains to consumers from simplification is furnished by what has been accomplished in so small, but so generally used a product, as lamp bases for electrical fixtures. A few years ago, there were being

manufactured in the United States 179 different varieties of these lamp bases which made necessary, even for the consumer in the home, the memorizing of a considerable specification before procuring a lamp which would fit the special socket which happened to be installed in that particular home. At the present time, the seventy different manufacturers who are producing lamp bases in the United States have reduced the number of varieties to six. In the same industry, as late as 1918, there were thirty-seven distinct varieties of attachment plugs in use, each one good in itself, but no one interchangeable with any other. At the present time only one type is made; with obvious advantages to everyone concerned.[1]

This kind of thing not only makes life simpler for the consumer, but also is of benefit to manufacturers, and represents for society a general saving of capital and effort. We have already seen that what is necessary to develop the efficiencies of the continuous process and generally intelligent management is the reduction of manufacturing processes to their fewest functional elements. Only when this has been done can full efficiency be developed. If we pursue our illustration of lamp bases and attachment plugs, we can see that if a manufacturer were to sell his product, he would have to meet all designs of fixtures. If he omitted any one of them he would shut off at least a section of potential buyers. If he had to make all of them, his routing problem would be enormously increased. Also he would have to have an enlarged planning and designing department; he would have to have many times

[1] For a description of these activities of the Bureau of Standards, United States Department of Commerce, see *Simplified Practice: What It Is and What It Offers*, Government Printing Office, November, 1924. *Cf.* also Chapter ix of *Your Money's Worth*, by Stuart Chase and F. J. Schlink, New York, 1927.

as many machines as he might if only one standardized product were made. Serialization, too, would be enormously difficult because of the number of necessary series.

This would obviously be just as true of almost any other product. It was with the conception of the considerable gains to be made rather easily in industry as a whole, that a Division of Simplified Practice was, in 1923, set up in the Department of Commerce.[1] Its services were made voluntary to industry. As combination and association have gone on, and as the competition among businesses has lessened, the services of this division have been called for more and more frequently. A summary of the extent to which simplification has gone is by now very impressive. More than 300 industrial groups have applied for the service offered by the government. In addition to this, and correlative with the changes made in plant practice, simplification has taken place independently in all businesses whose scope is any considerable part of its industrial field. Typical examples of the reduction of designs follow:

Commodity	*Former Number*	*Present Number*	*Reduction*
Forged tools	665	351	47%
Box-board thicknesses	244	60	75%
Cotton duck	460	94	80%
Paving bricks	66	4	94%
Tacks and nails	428	181	58%
Hospital beds	67	4	94%
Milk-bottle caps	29	1	96%

These are merely typical examples picked at random from a long list furnished by the Division of Simplified

[1] In a way the division owes its origin to the war, since it was in the Conservation Committee of the War Industries Board that its ideas were first worked out.

Practice. Most of them, though not all, represent the efforts of standardization of a single manufacturer persuaded to the reform by the discovery that many of his operations were a burden on the rest. A manufacturer of felt hats discovered, for instance, that even though his was a product which was, more than most others, dependent upon varieties of style and quality, he was selling 90 per cent of his hats in seven styles and ten colors. Up to that time he had been producing exactly 3,684 different styles. The benefit to him of concentrating on the 90 per cent seems obvious, and the losses to consumers must certainly be set down as negligible in view of the social saving which was made. A similar experience of a shoe manufacturer illustrates the means by which the persuasion to standardization came in his case. Before simplification, he manufactured three grades and 2,500 styles of each grade. He simplified his line to one grade and 100 styles. This 99 per cent elimination of variety reduced his direct production cost 30 per cent, overhead 28 per cent, inventories 26 per cent, and selling prices 27 per cent. It is interesting also to note that his turnover increased 50 per cent, his sales of women's shoes 22 per cent, and of men's shoes 80 per cent. Apparently consumers prefer a low price to a wide variety.

The greatest social savings come, however, from reforms which permeate whole industries—not only single businesses. The newly developed trade associations, to which we have already referred, have been important agencies in this. The Malleable Chain Manufacturers' Institute, The National Fertilizer Association, and The Chemical Equipment Manufacturers' Association, to name a few of many possible illustrations, have made simplification

a definite part of their programs, and have made savings which in the aggregate form a not inconsiderable part of our recent gains in productivity.

4. *The continuous process and the serialization of machines.* Anyone who has had any contact at all with modern manufacturing has seen the continuous process going on. What we often forget is that it is something new in the world, something which could happen only when a large volume of output had been achieved, when there was a wide and constant market and when the technicians engaged in supervision, paper-work, communication, and transportation, had mastered the details of planning, purchase, and assembly. It works best in plants where the product is built up from many parts, though the idea is also applicable in plants where the product results from the breaking down of the original material. The automobile is a familiar built-up (or synthetic) product and the continuous-process assembly has been worked out almost as thoroughly there as in any branch of industry. The manufacture of cement is even a better example [1] of an industry in which the serialization of machines and the elimination of labor have been carried out to a relatively complete degree.

Of the breaking down (or analytic) type a good illustration is large-scale meat production as it is carried on, for instance, in the great Chicago meat-packing plants. In the one case, parts are added as the core of the machine moves forward through the plant; in the other case, parts are gradually removed and taken away.

[1] For a graphic chart of the continuous process in cement manufacturing the reader is referred to *American Economic Life*, p. 273. Also for a description of the Ford production cycle at River Rouge, see pp. 222–3.

In either, however, the continuity of operations is preserved so that one follows another without interruption. The reduction of these to their least possible elements—the division of tasks of which we have spoken before—permits the introduction of machines and their ultimate linking up in continuous series. This latter involves the last step but one in the elimination of human labor. The last step would be the elimination of the men who add parts or who take them away.

It is of the utmost importance that serialization be complete and that the human feeding or removing should be reduced to an absolute minimum, because, so long as a human being remains, the pace of the process has to be a pace which he can keep. When he is eliminated there is no logical limit to the speed of operations. The rhythm can be speeded up indefinitely. The great gains which we noticed as we went over the figures for man-hour productivity in the automobile and cement industries were largely attributable to this speeding-up. Reduction in the price of products, shortening of hours of work, and the five-day week are obviously made more possible where the pace of production can be so increased as to turn out as many or more units in shortened days as in the old longer ones.

The writer has seen most intimately the development of the continuous process in the canning industry. Twenty years ago canning peas, for instance, was done by hand. They were cut, shelled, sorted, washed, blanched, tinned, cooked, and warehoused largely by the exercise of many muscular human frames eked out with improvised foreman ingenuity. Gradually order grew into the process so that each function was located with reference to the others. Machines, some of them mar-

velously complicated, could then be adapted to the functions. Threshers, graders, washers, blanchers, fillers, sealers, cookers, coolers, labelers—all came rapidly once the start was made. Now it is literally true that no one ever sees the peas until the can is opened. For they go into the machines on the vine, and the machines are so serialized that they need never appear except for testing to determine the necessary time for blanching and cooking different runs.

One may happen to be aware of such developments in any single industry with which chance has made him familiar and still not appreciate the applicability of the generalization to be derived. It will be discovered, however, on investigation, that the continuous process is so universal by now as to have become a main principle of factory operation. It is true, too, that the greatest gains are made in the late stages of the completion of serialization. For it is not until perfection is approached that speeding up can begin. It is this last stage which we have been entering in the few years just passed.

5. *Improved location, layout, and routing practice.*

It will at once have been seen that the development of the continuous process, of which we have just spoken, was contingent upon better engineering practice in plant-location, internal planning, and the routing of the product through the plant. Of these the latter two obviously contributed most directly: but plant-location also has its importance. For a business can quite obviously be tremendously handicapped by being badly placed with reference to a number of factors: raw materials or semifinished ones, markets, power, the high or low price of land, facilitating industries (such as banks), labor

supply, transportation and communicating aids, and other miscellaneous ones peculiar to particular industries. Or it can gain just as much by a proper adjustment of these, and location according to a more or less accurate measurement.[1]

[1] For many years economists have been engaged in working out theories of location both as explanations of practice and as guides to better practice. A general survey of the literature is contained in "A Review of the Literature of the Location of Industries" by Witold Krzyzanowski, in *Journal of Political Economy*, xxxv, pp. 278–91 (April, 1927). The most generally recognized work in this field in America was carried out as long ago as 1900 by F. S. Hall, using as data the census figures of that year. Seven factors are suggested: (1) nearness to raw materials; (2) nearness to market; (3) nèarness to water power; (4) favorable climate; (5) supply of labor; (6) capital available for investment; and (7) the momentum of an early start. An engineer's view of the important considerations is included in the discussion of plant location in *American Economic Life*, beginning at page 265. L. C. Marshall's *Business Administration*, 1921, includes a section made up of excerpts from economists' and engineers' various writings. It will be of interest to quote Mr. Krzyzanowski's opinion of our industrial efficiency along with what seem to him our theoretical shortcomings, with particular reference to plant location, of course. Perhaps it ought also to be said that he is a professor at the University of Lublin, Poland. "The United States is an ideal field for investigations in industrial location because industry was created in this country only a little more than a hundred years ago in competition with England and has reached a magnificent development. There is an immense territory in which, as shown by statistical data there has been a steady western trend of manufactures. There is, too, a rivalry between the North and South, and in the Mississippi Valley there is an expansion southward toward the Gulf of Mexico, an expansion which has been increasing since the opening of the Panama Canal. The large spaces of the West were opened by railroads only a few decades ago. The labor is the most mobile in the world, and the profits are enormous. There is the further advantage, from the point of view of such investigations, that when industry was created there were no old historical traditions, nor did an existing system of cities check the movement. And, finally, the country forms an economic unit.

"But it seems that the attention of the people conquering the territory was directed rather toward practical efficiency, and there

Here again there has latterly been an acceleration of progress caused largely by the consolidation or combination movement. Everyone is familiar with the spectacular scrapping of plants which followed directly upon the formation from formerly independent units of the National Sugar Refining Company, the International Harvester Company, the Standard Oil Company, the United States Steel Corporation, and others of the older so-called trusts. But the process has gone on more and more rapidly of late years, extending into all sorts of industries, including transporting and communicating systems, candy making, and the manufacturing of electric power, to name only a few miscellaneous ones. When combination takes place, a greater mobility of location is at once achieved because the number of units is increased and growth can go forward in those which are best located. Also, of course, there is the fact that greater financial resources make available better engineering advice and reduce the location-sensitivity which frequently attaches an old business to an original home no longer suited to it.

With combination and relocation on a freer basis taking place throughout industry there is a better chance to improve the arts of internal planning, especially if reorganization goes to the extent of rebuilding. For then the latest knowledge can be brought to bear in perfect freedom; and freedom can never be very great within the confines of old plants. We have already seen figures which showed the contrast between an old and

have remained certain gaps in theoretical investigation. In the literature of the United States there is not one large comprehensive work dealing with our problem. There are only a few short articles which barely touch upon the subject." *Loc. cit.*, pp. 288–89.

a new plant in textile-making. There was the difference of some 80 per cent in efficiency even with the same management and similar other engineering advice. Freer scrapping of plant and rebuilding to take advantage of improved layout technique are most conspicuous in just the industries where the productivity index is highest. There ought to be a lesson in this for industries still struggling alone in the old, often positively ramshackle, plants to be seen from any car window.

The layout expert has in mind most conspicuously the achieving of continuous process and complete serialization; and his work, combined with that of other technical men of the research type, frequently secures most astonishing results when given a freer hand in a new location.

But some industries, such as makers of tool-parts, small machines, and other small products, frequently are faced with the problem of making dissimilar goods in one plant. The continuous process is more difficult to maintain under these circumstances, but even an approach to it is difficult without considerable attention to the routing of different jobs throughout the plant and proper organization of the functions and materials involved. So that this, too, has grown to be almost a science on its own account with an impressive paraphernalia of cards, charts, and statistics. But it does get results in a difficult situation.

6. *Careful pre-planning and enlarged reliance on paper-work.* Closely connected with these improvements in engineering practice is the general development of the idea of planning ahead and of working out programs and schedules of what may be expected to occur. The planning function takes place in view of the general situ-

ation in which the industry finds itself. It lays out a program of work which becomes the standard by which accomplishment can be tested. This is a great gain over older ways of measuring achievement which consisted largely in measuring against past accomplishment as a standard.

The fact that what can be expected is reduced to paper records is a gain of a similar sort. The preparing of quantitative expectation becomes a study in itself. Its practitioners become skilled in discovering all the conditions which may affect productivity and gradually come closer to a complete substantiation of the proposed schedules. A plan which is defensible on rational grounds, in which quantitative account has been taken of all forces which may have an influence on the rhythm of production anywhere, puts an obligation to be efficient upon the minor executives which was lacking before. It makes excuses harder to find and even more difficult to justify.

Such planning as this, it will be seen, is dependent upon a number of conditioning circumstances which until recently had not been common in industry. First there must be a general idea that plans are better than trusting to improvisation as problems arise. A problem in operating adjustment which has been studied in the calm atmosphere of a planning office is apt to be met, when it arises, with more smoothness and assurance than it could get in the hustle of the plant. When machines are stopped and actual operation waits for minds to work there is a pressure present which is not apt to lead to a good solution. But also there are other conditioning circumstances. Planning men must be trained men. They must have a certain mathematical, statistical, and en-

gineering equipment and they must have a place to work in as well as tools and equipment to work with. The acquisition of all these is fairly recent so far as most industries are concerned. And we are just beginning to get results.

All competent industrial engineers at present assume as one of the commonplaces of their profession that work will be carried on according to a most detailed and exactly devised schedule. The whole idea of a control of production, as a matter of fact, is contingent upon the preparation of plans. If production control is defined as "the preparation and administration of work in process" [1] its four functions are to be visualized as: 1. Pre-planning, 2. Scheduling, 3. Dispatching, and 4. Inspection. Of these the initiating and controlling one is obviously the plan. The plan will include budgeting, which we shall elsewhere discuss, but also it will include such other estimating efforts as the creation of a production schedule, detailed, and for any given period, complete, and the transposition of the schedule into man-hours of effort, units of power, and quantities of material and the distribution to departments of schedules showing their expected contributions to the general scheme. Pre-planning becomes more and more technical, but also more and more useful.

7. *Better general organization of executive functions and the development of the rule of exceptions.*

It will be seen from the foregoing discussion that the duties of the executives in industry have changed enormously in the modern types of organization. Many duties have been delegated to experts: engineers are en-

[1] *Bulletin of the Taylor Society*, ix, p. 278 (December, 1924).

trusted with layout and planning; other experts with problems of personnel; others with budgetary and accounting control; others with research and advanced practice. Some of these have been discussed; some will be discussed later. The whole effect has been to leave executives with fewer duties. In a going organization, indeed, fully organized under a well-thought-out functional scheme, the executive has no routine duties whatever. Every decision incident to a normal day's work is cared for without his knowledge or intervention. He will know of the steady flow of work only what appears before him in statisticians' and accountants' reports. It is sometimes said that the better an executive is, the less he has to do—which means, simply, that he has been a sufficiently good executive to organize affairs effectively, leaving himself out in the distribution of routine tasks.[1]

[1] A notion that executives no longer are to be loosely thought of as heads of organizations but as part of them, having definite responsibilities, and good or bad procedures, and achieving measurable results, is growing among industrialists. Mr. J. H. Williams [in the *Bulletin of the Taylor Society*, vii, pp. 47 ff. (April, 1922)] for instance, summarizes a chief executive's functions as:

1. To interpret the policies of the stockholders and directors in terms of the concrete problems of the enterprise and to represent them.
2. To work out with the directors the objective of the enterprise and the scope and limitations of its activities.
3. To select, appoint, and maintain the major executives necessary for the conduct of its affairs.
4. To present the objectives determined upon to the major executives, and to work out with them a plan for their accomplishment evidenced by a budget expressed in terms of men, money, and things, and subdivided according to the responsibilities for its execution.
5. To follow up the activities of the enterprise and keep the directors informed as to results and their significance.
6. To constitute an available sympathetic and informed counselor

The value of this sort of organization appears to be that the executive is left free to think about the larger problems of the industry. These larger problems arise mainly because of general changes which take place within and without the organization itself. The discovery of a new process or machine, a disturbance in price levels, a failure of sources of raw materials, the opening of new fields of competition, some unusual shift in hours or days of operation—these are a few of the moving forces which may, at any time, have an influence on the course of operations, and may call for new policies within the business itself. A business, like any other social group or institution, does not operate in a vacuum but in a system which is a congeries of complementary groups and institutions. Its place needs to be defined and constantly redefined. As changes take place in any part of the system, they affect, more or less, depending upon the immediacy of relationship, every other part. The really modern conception of the executive's function is this correlative activity.[1] It is his

to the major executives and to help them to adjust such differences as may arise among them.

7. To keep the major executives informed of each other's accomplishments and help them see themselves and their functions as part of a whole which is greater than any one of them.
8. To follow up and appraise the work of major executives in terms of their assigned responsibilities and budgets, and to help them see themselves and their work as their associates see them.

In all this there is no reference to the issuance of orders or to dealing with detailed affairs at all. These have no place in the executive's planned scheme of functions.

[1] A brilliant discussion of the functionalization of authority is to be found in "The Illusion of Final Authority," by Mary P. Follett, in *The Bulletin of the Taylor Society*, xi, pp. 243 ff. Executives who wonder what their situation really is, ought to consult it. Her con-

duty to anticipate so far as he can changes which affect his organization, or divine them at the earliest possible moment so that the adjustment may be smooth and instant.

Examples are not difficult to find which illustrate this. When Mr. Ford introduces a five-day week, executives of other organizations have to take account of the accommodations they may be forced to make to it. When a new source of power is opened up executives have to discover its application to their business. Within a period of some ten years, more than half the power applications in American industry have been electrified. No executive could afford to ignore this change. The same has been true with the change in the short-hauling of freight, most of which has, within a few years, been turned over to trucks rather than railroads. The same attention would have to be given also to the standardization of materials and processes. These are general changes. Much more intimate ones also take place which affect the internal organization. No modern business can maintain its health if it is not constantly accommodated to its world. The price of success is constant adjustment.

This freeing of the executive for thinking and for carrying through the major or minor reorganization activities, which become imperative, is sometimes called the "rule of exceptions." As the phrase implies, it

clusion is: "Moreover, the real reason that we have personnel work, the study of human relations in industry, is because we have waked up to the fact that the human as well as the mechanical side of industry can be studied . . . and give us control of the situations between executives and workers or between executives themselves. In short, business is coming to be considered not so much a speculative undertaking as a social enterprise, resting on scientific knowledge, controllable by further and further developments in scientific methods. . . ."

means the devotion of executives to other than routine problems, only those, in fact, which arise outside the established practice but which may affect it. They come to the executive through his study of the organization operating all around him combined with his study of the relevant world in which the functions are carried out. His success depends upon his imagination, his alertness, his openmindedness, and his willingness to entertain suggestions for change. Even here, however, he may have to have expert assistance. He may not be technically equipped to grasp the physical or chemical principles involved in a problem before him, or he may not be sufficiently familiar with personnel technique; he may not know anything of accounting practice. The research organization maintained by so many great businesses may be called upon to work out the principles involved and to test their practicability for their own particular organization. A great part of the work of research organizations is of the nature of assistance to this executive function.

This rule of exceptions may be regarded as applying to all executives also, not only, as at first appears, to those highest directing officials known usually as general officers. Plant superintendents, even department chiefs, function best when their routine is carried by technicians, and they devote themselves to the accommodations made necessary by exceptional occurrences. A plant superintendent may not have within his scope the making of policy concerning changing markets and new sources of materials or power, or even the changing of work-periods. But he may discover new routing practices, new layout schemes, new building materials, new types of foremanship and the like if he is sufficiently free and at the same time sufficiently alert. These may come to him through a

suggestion of someone within his organization—men do sometimes view their own work critically and discover ways to improve it—he may find it by the sedulous investigation of practices in other plants, he may pick it up from a trade journal (this is not at all unlikely), but at any rate he ought not to be so buried in routine tasks as to be immune to any slightest rumor of change.

This whole development toward the freeing of executives must have had an important part in the building into our system of the greater efficiency it displays in modern years. It must have made the general adoption of technical advances much more rapid. It has taken place much more rapidly in recent years because of the increasing scale of business, naturally, because in these enlarged organizations such advanced practices are always adopted more generously. We have seen, too, how recent has been the addition of contributory functions such as the research laboratory. There is here, it seems fair to infer, one of the modern developments which, along with others, has increased our output of goods. The extent of adherence to the rule of exceptions as we have outlined it, could be exaggerated easily, even at present, however, as any executive can say. He still has too much routine to handle in many places; but undoubtedly the general spread of a clear idea of what the rule implies is having an important effect in obtaining its wider adoption. That is a promise for the future.

8. *Better accounting control which gives the executive more instant and accurate knowledge of the affairs for which he is responsible.*

The modern conception of accounting is not simply that of determining profits and losses by striking periodic

balances, as it once was; rather that of the revelation of the business to itself. If an executive is to be freed, and especially if he is to have any summary, which will be intelligible, of the complex operations of the business, to assure him of a smooth routine, its accountancy has to present, in miniature, a picture of its affairs as they stand at any given time. Accountancy has had to grow more complex to meet this demand, but also has had to devise ways of presenting simply the essential tests by which successful operation can be judged.

The analysis of costs plays an important part in this, frequently revealing the sources of inefficiency; comparative summaries of output and input for departments, the attribution to their sources of contributions to progress are important to the understanding of internal operation. But also accounting practice can serve to picture more general relationships and so act as a guide to executive decision in larger matters. The whole effect is to bind the business into a comprehensible whole, its parts functioning together to a common end, and also to furnish warnings of needed changes for purposes of accommodation. It was of the utmost importance that this guiding function should be developed along with the others of the business for these purposes. The ingenuity of accountants is largely responsible for the superior knowledge we have acquired about business organisms and is an important contributing factor to modern efficiency.[1]

[1] In order to get a very clear notion of the part accountancy plays in the present productive scheme the reader would need to consult some of the standard texts on accountancy. James O. McKinney's *Managerial Accounting*, 1924, is full and authoritative. Some short articles have appeared from time to time in trade journals and these offer a detailed picture of accountancy in special fields, but in these

One of the most important of the problems faced by accountants has been that of allocating overhead costs and attributing them specifically to machines, men, and goods in transit through the processes of production. Unless this can be done successfully wage payments, of which we shall speak later, cannot be based on the productivity of the worker with any accuracy, nor can the comparative efficiency of different processes, machines, or groups of men be determined. Into the technique of accounting we obviously cannot go here, but perhaps enough has been said to indicate its intricacy, its difficulties, and its contribution to progress.

Not only accounting itself, but the whole matter of office procedure is in our time having a thorough overhauling.[1]

It is conceived, indeed, that office management should become as near an exact science as the management of other parts of the factory. It is perhaps seldom realized that from 1880 to 1920 the number of clerical employees in the United States grew from 172,575 to 2,951,008. It now outnumbers any other single occupational trade, if agriculture be excepted. The regularizing of the work of this mass of men is of no slight significance to productive efficiency as a whole. It affects not only accountants and accountancy but those other workers who have to do with planning and recording—in short, the whole paperwork of industry.

the general reader will find no interest. Industrial engineers recognize the necessity for development in this field along with others and seem to agree that its progress has been quite as rapid. They naturally stress its relation to production control. A typical paper may be found in the *Bulletin of the Taylor Society*, viii, p. 241 (December, 1923). What might be called an essay in the higher criticism is J. M. Clark's *Economics of Overhead Costs*, 1923.

[1] *Cf. Office Management, Principles and Practice*, by W. H. Leffingwell, 1925.

9. *Better financial operation based on more complete and accurate budgetary control.*

Financial operation to a corporation is simply the provision of the necessary funds for the continuance of all its activities. In general, funds for building and other permanent investments are provided by the flotation of securities of various kinds. The funds for current operations are provided by bank credit and by the cash on hand resulting from the sale of the product. It is a nice problem to determine how much is needed for permanent investment, provided usually by security flotation; but the difficulties here are not nearly so great as those which involve the provision of current funds. They do not occur so often, for one thing. Current funds have always to be on hand for the discharge of debts which are incurred in regular operation; they have to be of adequate amounts to meet all obligations; but they should not be so great that, within a short period, the loans provided by the banks to meet them cannot be discharged from the proceeds of sales. The period involved varies with the business, but, in general, should not be longer than is required to obtain raw materials, turn them into finished products, sell them, and collect payment.

This suggests that in order to maintain a workable relationship between operations and the funds which make them possible, there ought to be used a good deal of foresight in the matter. This will become more difficult as the business becomes greater and the number of departments and plants increases. In any case it is met by the device of the budget. This is simply a projected balance sheet, usually dated a year ahead, in which all the probable items of expenditure and income are entered and a balance struck. When it becomes clear which side is too heavy,

a process of paring down can lighten it or, if that seems impossible, greater efforts can be made to bring the other side up. Items of expense or of income in the largest businesses are never rigidly fixed. A little more or less can be charged for the product, a little more or less allotted to different departments for expenditures. There may be definite limits in some cases but never in all. On the whole, the process is one of adjusting various needs and possibilities to each other so that the total result is the best possible working arrangement with all really vital interests protected.[1]

In order to carry out this budgetary scheme and to get the necessary forward view of the financial operations for which arrangements can best be made some time in advance, there are prepared departmental and master budgets. The departmental budgets show, each of them, the expenditures to which the technicians of the department are willing to be limited, and the income which can be expected. These budgets have to be reconciled by entering them upon the master budget and changing them to obtain the necessary total result. There is usually a budget committee on which each department is represented and which has the responsibility of building up a workable scheme.

Without such a budgetary procedure executives are forced to operate under great difficulties in reconciling the various interests of the organization. There are always many more irritations than when the budget defines the scope of expenditure and so controls the extent of activities. When there is a carefully worked out budget, funds can easily be provided for all operations because the extent of the operations has in the first instance been limited by the extent of the available funds.

[1] *Cf.* "Audit of Process" in the October, 1925, *Bulletin of the Taylor Society.*

This way of carrying on is practically universal to large businesses and is rapidly being adopted by smaller ones. Its contribution to smooth functioning, certainty in the adjustment of relationships, and executive effectiveness, seems too obvious to need comment. But we learn more and more all the time about budgeting—especially how to forecast expenditures and incomes with greater accuracy—and there is no reason to suppose that considerable progress will not be made in the future in this respect.[1]

10. *Increasing the scale of operations; which results in a large volume of output with low per-unit costs.*

We have already considered the movement which has taken place, in this country most conspicuously, toward combination or at least the association, of like or related businesses. This movement plays a part in the technological system which is typical of American business; it was necessary if there were to be secured the savings in the cost of product which follow from enlarged activities. These savings are of two sorts. One is that which follows from the increased market advantages of large size, such as the undoubted ones enjoyed

[1] Mr. Joseph H. Barber of the Walworth Manufacturing Company, in a paper presented to the Taylor Society in 1924, explained at some length the methods used with considerable success by that firm for correlating sales and production programs by the use of a budgeting system. The details of planning and budget-making may be studied in the Society's *Bulletin*, ix, pp. iii ff. (June, 1924). The president of the company is quoted as saying that "Budgetary control is now one of the fundamental policies of the Walworth Company. It is our record of the past, our index for the present, and our guide to the future. We believe it to be an essential factor in our success." *Cf.* also, in this connection, E. E. Brooks, "Master Budgets of Sales and Production," *Bulletin of the Taylor Society*, viii, pp. 229 ff. (December, 1922), an account drawn from the experience of the Dennison Manufacturing Company.

in buying and selling. The other is that which comes from turning out a larger stream of goods.

It will easily be seen that if a firm is making a good which it is possible to make by machines, it is better to do it that way. But the initial equipment for machine operation may involve an investment, say, of $100,000, very little of which would be required for hand operation. Only if a great many units can be made is there justification of any sort for the necessary initial investment. It is not unusual in America, however, to discover a million-dollar equipment making a ten-cent article which is a revelation, in itself, of the distance we have traveled.

Once this investment has been made, the cost per unit of product drops remarkably as the output is increased. The limit of this economy is not reached until the full capacity of the machine equipment is reached. The apportionment of all the elements of overhead costs to each unit of product depends upon the number of units by which the overhead is divided. It costs almost as much to allow a plant to lie idle as it does to operate it. This is not strictly true, of course, since an accurate statement would always involve calculating the proportions of direct and overhead costs involved in the particular manufacture. The main items of direct costs are labor and materials. Most of the others are overhead and subject to decline as the volume of output increases.[1]

Here there is one powerful argument against reducing

[1] Such a bald statement merely outlines a large tendency. It must necessarily be subject to considerable reservation in many cases where the thing has been overdone, as it seems to have been by the Chicago meat packers. Mr. Stuart Chase makes reference to this in his amusing discussion of the merger situation in *New Tactics in Social Conflict*, 1926 (p. 144). Arguments pro and con are summarized in Eliot Jones, *The Trust Problem in the United States*.

the hours of the work-day or the days of the work-week. Every hour the machines run reduces the cost of the products. It suggests that in a system in which the gains from these reduced costs were more widely distributed, it might be possible to work machines in shifts so as to lengthen their work-day, even if that of the workers was kept down. Perhaps the only reason this is not done is because of the present overcapacity of most of our large-scale businesses, a discussion to which we shall return later. The thing to see here is that so long as machines can be kept at work there will be a progressive lessening in the per-unit cost of the goods they turn out. And this will be maintained up to the limit of their full-time capacity.

It ought also to be pointed out that as one industry after another changes to a large volume basis, the economies communicate themselves from one industry to another. "Machines to make machines to make machines," is a familiar phrase. When the total number of related industries are subjected to the completed machine process, serialization and all, the cost of finished products is cut down progressively.

11. *Development of the policy of taking a relatively low price for a large volume as contrasted with a high price for a small volume.*

It is at the point where we discover that the cost of finished products has been enormously reduced by our way of making things that business policy concerning prices becomes important to the technological process itself. For obviously the only way in which the increased product can be sold is by reducing prices as costs come down.

The modern large-scale business enjoys something

of a monopoly—which is to say that it has some power over prices. It can, within limits, keep them up, or it can reduce them. If it keeps them up, it will, in the long run, presumably, sell less goods than it would by lowering them. This choice is frequently too much for business men, who are apt to consider a bird in the hand as more desirable than two in the bush. The possibility of making more profits by reducing prices (because of the resulting economies of operation) has a paradoxical sound. But it is nevertheless true, in all cases, up to the capacity of the plants and equipment already provided. Frequently a compromise is affected in policy-making which reduces prices to some extent but not so far as is possible. It is important to see that the maintenance of prices at any point above costs (plus fair profit) necessarily restricts the market and volume of product, and so raises costs. A business which is really forward-looking avoids this vicious circle and goes all the way in the policy of reducing prices. When it does this it protects the consumer's interests along with its own.

The fact that we have gone a long way in this direction in the United States is obvious. That our voluntary industrial policy is as wise as it might be is questionable. The difficulty is not only that keeping prices up restricts the volume of use of any one product, say of electric power (electric companies being among the worst offenders), but that it makes costs greater, possible selling prices higher, and costs necessarily higher, because of restricted use, for every other product into which it enters. In other words, it restricts consumption and lowers standards of living.[1]

[1] It will be remembered that Mr. J. H. Van Devanter, from his study of the singular achievement of the automotive industry set

In an earlier book [1] the writer analyzed this problem. A paragraph or two are in point: "With the inevitable tendency to combination under the influence of decreasing costs it seems almost inevitable that (in time) there should be a control of prices which harms consumers. It is inherent in the very nature of modern business. And there is a separation, therefore, of the interests of producer and consumer—that is to say of seller and buyer. With an "open market," free bargaining, and no restriction or manipulation, both parties to a bargain normally benefit because one wants what the other possesses and willingly gives up something for it which is desired (or which represents something desired) by the other party to the bargain. The only compulsion is this mutual inclination of each for the property of the other. But when markets are not open and bargaining is not free, one party to the business contract gains something at the other's expense."

This is what may happen, is what, indeed, has usually happened in the past. And when such a disadvantage is suffered the only remedy lies in some kind of public control of price which will protect consumers. An industry in the early stages of the combination movement, as the automobile industry now is, passes on all its cost advantages to consumers. Later on it displays a tendency to care less about reduced costs than raised prices which it can maintain because of its control over the supply: consumers are harmed. This is the theoretical basis for price regulation; but if industries could learn that the wiser policy is a sustained search for efficiency

down as one cause of its superiority the "policy of passing on reduced costs to consumers."

[1] *The Economic Basis of Public Interest*, 1922, Chap. II.

with a continual passing on to consumers of its savings they could maintain themselves as alert, progressive, service-giving social organisms rather than the objects of popular suspicion and distrust and free themselves from the necessity of regulation. The fact that much of American industry has been, in the years just past, rather in the earlier than the later stages of the combination movement, has tended to conceal the real dangers involved. There is a difficult problem here which will have to be faced sooner or later; for the present it is probably true to say that our industry, as compared with other national systems, has more consistently moved toward the lowering of prices as costs were reduced and so achieved a greater volume of product, which, in turn, has intensified the economies of large-scale operation.

12. *Reduced inventory burdens, achieved through quicker turnover, simplified marketing, and improved transport and communication.*

One of the consequences within industry itself of the development of the "machine process," as the industrial system is sometimes called, was an immense piling up of goods in process of transit through it. For, although the total amount of goods produced in any given period was increased, the period of time wool or cotton or wheat existed in raw or semifinished states was considerably lengthened. So that, after development had gone on for some time, there came to be a great store of goods in warehouses, in railroad cars, or ships, and in the hands of wholesalers and retailers. It was necessary, on the whole, for industry to carry a great burden in protecting, transporting carefully, and guarding against changes

in the price of this great stock. Numerous social devices were built up for this purpose. Improved warehouses, which cool or heat, dry or dampen, were devised; better transport facilities had to be provided with more expensive equipment for adequate protection; insurance, both against loss of the product, and against possible loss of profit on it, came to be a recognized feature of the system. This last, for instance, accounts for all our expensive machinery for dealing in futures on organized exchanges. And the whole necessary series of arrangements accounts for much of the costly middleman-marketing system which has been inserted, bit by bit, into the industrial structure.

It began to be seen, however, when these arrangements had become obviously costly and even unwieldy, that it would be desirable to escape from this burden, at least so far as this was possible. The way to do this seemed to be to reduce the amounts of goods carried at any one time by speeding up processes everywhere. This reduction, it must be understood, is not absolute, but rather is relative to the amounts of finished goods turned out. In proportion to the total sales, the inventory carried, it seemed, could be reduced by turning over the product more rapidly, by simplifying the processes of assembly and sales, and by more rapid transportation and communication. Better paper-work and superior planning also entered into the picture.

Here we are face to face with one of those occurrences in the system which cannot be traced to any one cause. It has been remarked that industrialists set out to reduce these burdens when they became unwieldy. But all the developments which had this effect took place not only for this reason but for others also. This one

is separated from the others, which are also discussed, for the sake of achieving a workable simplicity. This has to be understood throughout these discussions of probable causes—in other places as well as here. At any rate it happened and is sufficiently important to demand attention.

Quicker turnover has obvious good results. If, in proportion to the amounts of goods sold, fewer are carried in stock, many items of expense are reduced. Insurance may be carried for a shorter time, there is less deterioration in quality, changes in the type of goods wanted are less likely to occur, improvements in technique which make the good obsolete are less frequent, and the danger of loss of profits from price changes is less serious. This quicker turnover is achieved by concentrating on highly standardized goods, by reducing prices and so widening demand, and by the use of advertising to stimulate sales. We have already spoken of "simplified practice" as resulting in cutting out infrequently-called-for goods. These other developments have the same result. It is clear that the carrying of a complete line of goods is about as expensive whether they are cleaned out and replaced once or twenty times a year. A good illustration is furnished by the contrast of a country merchant with his few sales a day and one on a busy urban corner who hands them out as rapidly as is physically possible. The total price of the inventories might be equal in each case, though the country merchant might very possibly have the larger one because of the necessity for carrying a mixture of obsolete and modernized goods. But the proportions of inventory to total sales would be all to the advantage of the city store, in which case comparative gains from all the

sources I have mentioned would accrue to its proprietor. Indeed this is one of the great sources of the advantage which chain stores have over individual ones. The same advantages are open to modernized and large-scale manufacturing businesses as to merchants. And precisely the same contrasts are observable.

Simplification of the processes of assembly and sale have had a powerful influence in this same direction. When a business learns to get its raw materials in exactly the balanced amounts required to complete the finished product without having anything left over to be carried, protected, and insured, it has learned the lesson of the merchant who carries nothing his customers do not want, and want often, to complete their standards of living. This seeming simplification may be achieved by complex means. A greater organization to assemble goods will increase the expenditure for this function directly, but will register a total saving for the whole production process. Similarly with the sales force which learns to reach, expeditiously and cheaply, the potential users of the products which are made. An increase in the sales budget may decrease total costs. In these two functions considerable gains doubtless remain to be made. Sales forces, particularly advertising departments, learn to fool their own organization as well as the public, sometimes, and more or less permanently, into considering them as far more useful citizens than they really are. There is much waste in advertising, as anyone who reads the *Saturday Evening Post* or any newspaper knows. But there are efficient advertisers and these perform a useful function to their industries.

Quicker transport and better communication have

helped too. Reliability of the transport system obviously reduces the stocks which need to be carried at any one time. A manufacturer need not carry a year's or even a month's supply of steel or paint or glass. He can secure its even and uninterrupted flow into the plant in the requisite balanced amounts from day to day. And if his sources of material are close by, he can secure them hourly, by maintaining his own trucking service. All this is made more possible by the easy access of individual to individual by mail, telegraph, or telephone, facilitating aids without which efficient assembly and sales would be almost impossible.

Even these processes are not sufficiently certain and smooth, sometimes, which accounts for a part, at any rate, of the development toward vertical combination which is taking place. Manufacturing businesses reach back toward raw material or semifinished material supplies or forward to the retailing of the product. When these, or either of them occur, the marketing functions still have to be performed, and still cost something, but they are carried out as arrangements among the various departments of one firm instead of as open-market operations. Costs are reduced by the superior efficiency achieved and also by the elimination of the profits of the various middle-men—not an inconsiderable item usually.

We see that we have here a series of developments which have wider effects than merely the reduction of inventory burdens, though this is important: We have, in effect, a definite and fairly consistent movement toward smoother working arrangements and ultimately, of course, toward reducing costs and socializing industry. That all these things are happening all around us in the in-

dustrial world any informed person knows. The desire has simply been to call attention to them as a few among numerous other occurrences which may account for those figures which displayed an increased general efficiency.

13. *Reduction of trade ignorance and secrecy, resulting in a more rapid spread of improved practices, machines, and processes.*

It is becoming less and less possible for any literate person in business to be ignorant of what is going on. In a sense no one's business is his own; it is everybody's. All the facilitating mechanisms of modern life, which have been spoken of in other places, contribute to this. Nearly every branch of trade supports a technical or "trade" journal, some of them, several. Easier communication by rail and motor bring business men together oftener, and what could be more natural than that they should talk shop? There are very few kinds of trade which do not have an annual or semiannual convention or meeting at which there are orgies of shop-talk.

The excellence of trade journals and the wideness of their circulation would make a considerable impression upon any hitherto uninformed person. They contain all kinds of technical information; they are widely illustrated; and, as a consequence, they make available to anyone a good deal of what otherwise would be known only to a very few of the exceptionally well-informed. Their staffs—and this is important—take great pains to gather and classify all the data they can get hold of, an activity which would not be carried on at all if it were not done for this purpose. One outside the trade would not find these journals interesting in themselves; they center closely on technique. But this makes them all the more

interesting to technicians. And they are, as a matter of fact, almost universally studied.

There are many of them, however, which are not strictly trade journals but which have to do with the technique of manufacturing, of transportation, of warehousing, and the like. There are others which have to do with personnel or with phases of engineering or with similar activities. But though they might be differently classified, they all have to do with the operation of the industrial system and they make secrets very hard to keep.

The result of all this technical education, which goes on more and more universally, is to spread very rapidly information concerning any change in processes or in machines. From the social point of view this is excellent. It serves to bring all units of industry into line with the most advanced very much more quickly than could be done in any other way.

Two other factors might also be spoken of which have this effect. One of these is the freedom with which research laboratories attached to industry publish their findings. Frequently scientific papers are to be found in the journals published by these laboratories themselves; and quite as often the journals of the learned societies have contributions from the staffs of industrial research organizations. This forms a widely known body of knowledge which is invaluable to these workers. The other, somewhat different, factor, is the advertising of machinery makers, especially in trade journals. The quality and the quantity of these advertisements are noteworthy, especially in trades in which combination has not gone so far as it has in others. They bring a good many late developments immediately to the notice of everyone in the trade and resistance to advance is much more easily broken

down because of them.[1] The impression is difficult to escape that here is a considerable influence toward quickening business imaginations, toward getting out of technical ruts, and toward making the most advanced the standard of the whole in industry.

14. *The increase of salvage operations and other ways of reducing wastes.*

The most spectacular example of what can be done to eliminate the outright waste of materials is furnished by the salvage department of the Ford Motor Company.[2] But other large concerns also have these departments whose business it is to see that all materials are used until their possibilities are exhausted, whether they happen to be lubricating oils, steam power, lumber, metals, or fabrics. Mr. Ford is certain that the service of this department has saved $7.50 per car for his total output. In our table of advances in efficiency the example of the Westinghouse Electric Company also was cited. Illustrations from various steel, sugar, cotton, and other industries can be gleaned from trade journals. On the whole there is an astonishing amount of attention being given by managers to this obvious means of reducing costs.

I say obvious, because by now it has come to seem obvious; but it has not been so very long. Throughout the headlong development of American business, until

[1] A reference list, prepared in one engineering library, when it grew to several hundred titles, was obviously too unwieldy for even research use. Even a selected list ran to nearly a hundred titles, all with files to be examined. If there are readers of this book who have looked into no trade journals recently, a journey to the nearest library will supply the impression one must gain of an immense expenditure of effort of a highly expert sort on the activities involved in maintaining technological intercommunication.

[2] Described in *Today and Tomorrow*, 1926.

it entered its present highly technical stage, such matters were considered to be of little moment. The typical rough-and-ready manager or superintendent of early business spent little time on such details. All his energies were employed in getting through his plant, by main strength if necessary, a certain amount of product. Refinements of control and departmental coördinations such as are necessary for waste-reduction had to wait for the well-trained eye and hand of the engineer with a genuine respect for the materials with which he works and a hatred of time- and material-wastes. For material-waste also involves a waste of time, since the material has had to be made. How easy it is to throw away a quart of oil here, a ton of iron there, an old belt, or a brass fitting, anyone knows who has worked around a factory at all. Also he knows that a certain scale of operations has to be reached, before such wastes receive much attention.

It is necessary usually to have an organization of some size before technical departments are built up. A small plant will hardly ever do much paper-work and advance planning. It is almost true to say that paper-work is proportional to size. And until a certain standard of technical excellence of this sort has been attained, it is not likely that little leakages of material will be detected. Furthermore, it is necessary that something be done with salvaged material. And to carry out the necessary reclaiming operations there has to be an amount of reclaimable material which will make it worth while. A small plant is so definitely handicapped in this matter, that it is easy to see that here is one of the distinct advantages gained from our recent increase in size.[1]

[1] Although one who studies technical and trade journals will discover, I think, that an increased amount of attention is being

The definition of "waste in industry" has been undergoing an overhauling of late years which has brought into its scope many kinds of inefficiency not hitherto included. The report of the Federated Engineering Societies a few years ago made the first comprehensive extension of the definition and surveyed American industry with the definition as a criterion.[1]

What waste is to the engineering mind may be gathered from this list of the main sources of technical waste in the six industries which were examined:

1. Faulty-material control—workers sitting around waiting for materials.
2. Faulty-design control—lack of standardization of equipment and products.
3. Lack-of-production control—bad scheduling of work through the factory.
4. Lack-of-cost control—absence of cost accounting.
5. Lack of research—the present scarcity of technical research departments in factories; lack of statistical information on markets and demand.

given to small plants in this as in other respects. Perhaps this follows from a growing realization that small-units are not necessarily to be eliminated so rapidly as was thought a few years ago. Some operations lend themselves well to small-scale plants; and even where ownership and management are centralized, it is frequently found advantageous to decentralize work. A good illustration is the series of small plants, based on power resources, established by the Ford industries within trucking distance of River Rouge. Notably efficient small plants are not difficult to find under separate ownership. The Plumb tool-making business in Philadelphia is an example. But the main generalization is probably true; that large organizations are apt to seize on new efficiency devices more quickly.

[1] *Waste in Industry*, by a committee of the Federated American Engineering Societies, Herbert Hoover, chairman. The best summary and discussion of their findings are to be found in Stuart Chase's *The Tragedy of Waste*. Mr. Chase's book makes a number of notable contributions to the discussion of waste. Readers are urged to consult it.

6. Faulty-labor-supply control—lack of personnel departments and consequent high labor turnover; excessive hiring and firing.
7. Ineffective workmanship—lack of vocational training, resulting in high spoilage factor.
8. Unemployment—cyclical, seasonal; including strikes and lockouts.
9. Idle material—deterioration and obsolescence of excess stocks.
10. Idle plant—failure to use plant and machinery to capacity, on balanced load basis.
11. Restriction of output by management.
12. Restriction of output by labor.
13. Preventable sickness.
14. Preventable accidents.

What was meant here in speaking about salvage operations is manifestly only a small part of this. But the other matters either have been mentioned or will be later. What the engineers think of as "waste" is any way in which time or material may fail to be put to its most efficient uses. In a sense our failure to educate our citizens properly or to make the greatest possible use of women's capabilities may be thought of as waste within this definition. To this there can be no possible objection. The material of our discussion here has been organized differently, however, since we are trying to account for increases in productivity rather than failures to do as well as we might in advancing it. That we do not achieve anything like an ideal standard anyone with a realistic knowledge of industry knows only too well. A centering of exclusive attention on our failures, however, may blind us to a certain real progress we are making, the evidence of which was adduced earlier. What interests us most is why we are progressing, not, at the moment, why we are not progressing as

rapidly as we might, though that too is eminently worth studying.

It seems important, then, to point out that in certain places, notably large-scale businesses, the problems of outright wastage of time and materials are being studied and have been partially solved by setting up technical salvage departments and insisting on complete use. One other factor in this situation might also be mentioned. We have already discussed planning and paperwork and have seen something of how it operates to facilitate smooth coördination and operation. One of its contributions, most in point here, was not mentioned before. It has been the experience of most of the reclamation departments that careful study of material wastage usually revealed the possibility of eliminating a good deal of the reclamation by better planning. When the Ford organization discovered, for instance, a great waste of lumber from the crating of parts shipped into its plants, it soon saw that if it planned this crating better these boards could be used as floor-boards for the car. This is perhaps a small item. But hundreds of others were also discovered. In this way the work of a salvaging and a planning department, if carefully coördinated, can make immense savings. Salvaging can be very nearly eliminated in a steadily running large-scale industry in this way—another illustration, as Mr. Ford remarks, of the substitution of head-work for hand-work, of the acceptance by management of its proper responsibility in production.

15. *Improved communication and transport facilities, and better organized exchange markets.*

It must be clear by now that any mechanism which tends to strengthen the bonds between the various units

of the industrial system would tend to make the system more like a functioning whole, and this is highly desirable. The tendency toward such a strengthening appears to be undeniably present. We see its general results in the growth of associationism both of formal and informal sorts. When we try to locate the mechanisms which are bringing this about we are forced to speculate, to assess causes which cannot be determined quantitatively. A more or less shrewd guess is, however, possible. The suggestion is ventured that it is the facilitating mechanisms, businesses in themselves, yet existing for the service of other businesses which have helped most.

Some of these have been mentioned; such things as trade journals, freely-operating research departments, the convention habit, the concentration of businesses into packed urban areas, and the like. We have not, however, mentioned the particular mechanisms which, by their growth and perfection, have made all these possible. There are also improved communication and transport facilities and organized exchange markets. The close linking of businesses by these means is perhaps partly a result of the general development of business but also partly a cause. This is again a matter in which a part, developing to complete a whole, may, when it has developed, lend new strength to the whole itself. It is as though we assumed a man without the superior mentality of modern man who could function well enough on the level of savagery but who, when he had developed his world to the extreme limit of his organizing ability, found his brain improved and himself better able to function because of it. He is better because society has developed; and society is better because he has

developed. Both are causes; both effects, possibly. The results are the same.

Communication, transport, exchange markets are, in a sense, the nerves and coördinating centers of the economic organism. And, as these develop, the organism functions in a more complete fashion, more intelligibly, more as a whole. It becomes quick and purposeful instead of clumsy and irresponsive in its several members. It is only truthful to say that we have not gone very far toward achieving this alertness and certainty in industrial affairs. One has only to look about to perceive the untruth of any such generalization. But it seems equally truthful to say that we move in this direction, becoming more intelligible in action, more coördinated, more like an organism with defined aims and the power to achieve them—not final aims, for a program does not necessarily imply that, but with temporary objectives, which we can measure and can know how to approach.

When, then, we link a continent with telegraphy and especially telephony (and with wireless telephony just in the offing) we quicken the nervous system. If it had taken a man half an hour to remove his hand from a flame into which it had accidentally plunged, or a quarter of an hour to make the necessary decisions concerning any of the affairs of daily existence, he would not have got so far as he has in adapting himself to nature. So businesses are enabled to move faster, to make quicker responses to the necessities of outward situation, to accommodate themselves almost instantaneously to the world of which they function as a part. Our comprehension of affairs is increased by the flooding into our minds of the reams and reams of print which are rele-

vant to our problems although much of its total mass comes to seem like a nuisance. Telegraph and telephone stand behind this print—together with improved postal facilities, of course—and enable its flow to become greater and greater and faster and faster. What happens in the remotest corner of the world, which is of use to us, is made known almost as soon as it happens. If there seems to be a great wastage in the floods of print which come to us and are tossed away unread or simply glanced at, we must remember their probable uses to others, and also that there still remains a good deal of clumsiness about its collection and its delivery to the right sources. We have still to master that art. And yet we have seen that there is a great development of daily, weekly, monthly trade journalism. This is a movement toward news selection, toward the winnowing for us of wheat from chaff. And we make progress at this.

But the new means of communication do more than collect news for the printed matter which comes to our eyes. They enable us to act on it at once. And so we become linked in tighter and tighter bonds. Business neighborhoods are extended, business is linked with business, industry with industry. A concern with offices in New York or Chicago may be in continuous communication with its plants anywhere. Within plants, these services link department with department, shop with shop. Millers can be in touch with wheat storages, tire manufacturers with London rubber houses, machine plants with steel mills. Communication in its modern forms seems an unquestionable means toward closer coördination.

But not only can such adjustments be arranged for:

the goods also which are usually involved, can be moved, quickly, safely, and certainly. Modern transport makes this possible. Not only by rail, but also by road in the ever-present motor truck. Plants need not be held up for supplies, sudden demands can be met, foresight, which improves, is also supplemented by quick response to unusual calls. Nothing could be more fascinating than to enlarge on the techniques of communication and transport: how the motor truck developed out of the sporting car, surmounting the difficulties of internal combustion, the smooth transmission of the power, starting and stopping and cooling, until there were developed the tremendous facilities of the carriers we see on all the highways of travel now. How the electric engine came into railroading, how the steam locomotive was improved to haul heavy freights at express-train speed, how the Diesel motor, electric transmission, and mechanical navigation grew into ocean shipping, how the relay system made long-distance telephony possible, and how machine switching improved connection service—all these might be dilated on at length, but this would not especially serve the main purpose here. The reader is probably already generally familiar with these things. The real purpose is served if the idea is conveyed of the vastness of these developments, for then the implications can be drawn of closer linking, better coördination, clearer division of tasks, greater readiness of response to emergency, and a whole better operation of the various units of the system as a system.

It is perhaps hardly necessary to point out also that all these gains are facilitated by organized exchange markets. To bring buyer and seller into constant in-

stead of intermittent communication, to provide a place where, at a price, goods of certain sorts can always be bought or sold, to provide centers of information, to create a class of specialists in forecasting future supplies and likely demands, to level out, somewhat, fluctuations in price, all have the effect of steadying, unifying, and coördinating the system. There are undoubtedly other and opposite forces of disunity also engendered in these markets, for speculators do not perform their linking services consciously. Their interest is in making a profit and to do so they may have an advantage in keeping buyer and seller ignorant of each other's needs, or in creating fictitious market situations by various means. All this is true. But their very situation limits their power for harm, somewhat, and leaves a safe margin of social gain. Or so it seems. And the problem is not one of abolishing markets and speculative functions, as some reformers would do, but of controlling their functions, stimulating the good and repressing the bad.

16. *Improved financial mechanisms.*

It is obvious that financial mechanisms can have much to do with making industry run more or less smoothly. They are so intimately related to the business structure that it is sometimes difficult in their most modern forms to separate the two. But even where so great a development as this has not taken place, the intimacy of the relationship is still such that industry itself can be greatly facilitated or greatly hampered as the banking system is well or badly operated. For it is from bankers that industry acquires the funds with which it begins and with which it carries on, and effi-

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ciency with which the bankers' function of capital collection and allocation is carried on is of the utmost moment to industry itself.

In recent years the two most prominent developments in the field of finance have been: first, that banking has grown bigger and more unified just as other business has; and second, that an entirely new national banking system has been put into operation. Both of these developments have their importance to industry. Banks always have existed at the center of inter-business functioning. They operate at the point where businesses most frequently conflict or coördinate, and this position gives them a strategic hold on the whole economic life of the community. It is the so-called investment banks which make possible the original gathering and allocation of capital with which businesses are begun. This is usually done by the underwriting and floating of security issues. Commercial banks carry on from this point, collecting and allocating the funds for financing business turnovers, so to speak—that is to say, financing current operations. As a need on these accounts for greater sums arises, banks need to be bigger and more closely coördinated with each other. And this is exactly what has been happening in recent years, as anyone knows who has followed the almost daily news of mergers and of new capital issues by financial houses.

There are, of course, possibilities of harm in this, too. Bankers are not fundamentally more social than other people. It is sometimes suggested, even, that they are more selfish. They do often exploit businesses with which they have connections, for their own gain, but with proper control these difficulties can be more or

less obviated, although we have not as yet gone to the necessary lengths in controlling them.[1] But growth of banks has made possible such improvements, for instance, as are involved in greater specialized knowledge within the enlarged institutions for the assistance of the businesses they assume to serve. Officers can be assigned, who have some intimate knowledge, to care for the accounts of particular firms. There can be a better balancing of funds for various different uses, a wider judgment of what is really wise in business as over against what is merely momentarily profitable. There can be, in other words, more respect for policies which can be said to be social rather than individual as banks obtain a size comparable to the size of modern businesses. It might also be said that there has been a reduction in the old sort of trade secrecy among banks as among other businesses, and many new developments of technique, such as budgetary controls, accounting practices, machines and the like, which facilitate the functioning of financial mechanisms, and which could not come in until a sufficient size was obtained so that the volume of transactions became large enough to permit of the

[1] What these banker-industry relationships really are has been too little investigated. W. Z. Ripley's *Main Street and Wall Street*, 1927, tells something of the story incidentally. A recent essay by Mr. H. J. Putz (Columbia University Library, 1927) goes, in some detail, into the history of automative company financing. The whole result is not a particularly favorable picture. Bankers have used this industry for their own profit much as they used the railways earlier. But the impression one gains is that the outright piracy is considerably reduced. Control of capital allocation for public benefit rather than for that of interested groups, will be mentioned later. The history of automobile financing offers generous testimony as to the need for something of the sort if we are ever to achieve a subordination of business aims to technical requirements.

necessary division of tasks and the introduction of special processes and machines.[1]

The new banking system, of which I have spoken, is, of course, the Federal Reserve system, inaugurated just before the beginning of the Great War to replace the old national banking system. It has had several good effects. It has helped to show bankers their true function by linking them up indissolubly with all other financial institutions into what is, for many purposes, one complete system instead of a series of independent units.[2]

[1] One who is interested in this point might consult the files of the many trade journals in the financial field, and the books on bank organization and practice, of which there are many. An excellent short treatment from the point of view of a management expert is "Problems of Bank Organization," by H. A. Hopf, in the *Bulletin of the Taylor Society*, xii, pp. 352 ff. (April, 1927).

[2] The passage, recently, of the McFadden Bill, which, among other things extended indefinitely Federal Reserve bank charters, consolidated and made permanent this feature of the system. Mr. E. E. Agger, author also of *Organized Banking*, reviews the possible changes in the control policy of the Board in "A New Orientation in Federal Reserve Policy," in the *American Bankers' Association Journal* for April, 1927. So far as control is concerned over the operations of business, which is a matter of the utmost interest to industry, the two crucial policies are those with respect to the discount rate and to open-market operations. After the passage of the McFadden Bill, there was a good deal of public notice of a rumored change in Federal Reserve policy to make credit procedure more uniform and to bring all the operations of the District banks more closely under the control of the Board. Mr. Agger feels that there is nothing new in this: that it was originally the intent of the act and vitally necessary to the working of the system. Among other things he says: "Orderly credit development implies the harmonizing of credit policy with business needs. Both 'stringency' and 'inflation' are to be avoided. Credit must be kept supple and elastic. It must be made to respond to, rather than to initiate, changes in the general business situation." This is a very concise statement of our Reserve policy. Many who are interested in industrial control and who see in the financial mechanism the readiest and most efficient means would wish to see the policy shaped toward the initiation of business

A good deal of banking still remains dependent upon private initiative, of course, but the tendency is undoubtedly toward a pooling of interests and concerted rather than individual action in all the crises of economic life. The very structure of the system itself, with business men on the various controlling boards, has helped to give a somewhat more industrial point of view to banking in general and to bring more closely home to bankers the idea that they exist to serve industry. And in a number of other ways it has helped too. It has, for instance, pooled reserves and, as a consequence, has raised the probability of the safety of deposits, and has reduced the likelihood of the failure of any individual unit in the system—a feature which is bulwarked also by close scrutiny of reserves and types of collateral. It has also made currency more elastic by injecting into the currency system the new Federal Reserve notes, which are based on rediscounted commercial paper, the theory being that the volume of rediscounting will represent roughly at least the volume of business transactions. And this actually has had the effect of increasing and decreasing the amount of currency as business increased or decreased in volume. The important consequence of this is that price changes have been made less violent and more orderly.

The Federal Reserve system, also, finally, has instituted some measure, at least, of control into the whole system of business, through the financial mechanism, by the manipulation of its rediscount rate and by its open-market operations. This is admittedly only a rough control and serves to stimulate or retard business

changes, rather than remain, as it is, merely a negative stabilizing influence.

activity mostly in general, not in specific, industries where danger may be imminent. But this latter need is met by the less formal control which is exercised through the need of businesses for current finance and by the scrutiny of the paper offered for collateral by the Federal Reserve officers when it is offered for rediscount.[1] No one can be certain just how much of this informal control takes place, but no observer of contemporary industrialism can conclude that something of the sort does not happen. The whole result of these changes of recent years in the financial system has been to make it better adapted to the kind of a system of business which has been developing, and to facilitate the movement toward greater coördination, if not control at the center of its affairs.

17. *The bringing into use of new and better power resources more suited to our technique, more flexible and less wasteful; and continued progress in the technique of generating and applying power.*

One cannot be otherwise than humble in the face of all the multitudinous facts concerning the application

[1] For a discussion of the place of financial institutions readers are referred to Mr. H. G. Moulton's *Financial Organization of Society*. The section on the "Federal Reserve System" will furnish a short treatment of our own unique adaptation of the Central Bank idea; that on "The Financial System and the General Economic Organization" will serve to place this institution among the rest of our system. Open-market operations are discussed by Mr. John R. Commons in "The Stabilization of Prices and Business," *American Economic Review*, xv, pp. 43 ff. (March, 1925). This feature of our banking practice has had too little attention, considering its possibilities. An interesting discussion of the general functions of central banks will be found in the same issue of the *Review* (pp. 53 ff.), "What Can Central Banks Really Do?" by T. E. Gregory of the London School of Economics. Open-market operations of the Federal Reserve Board are also discussed in the 1923 and 1926 *Reports* of the Board.

of power in modern industry. The writer has, for years, been following in the amateurish way of one who is not an engineer, the revolutionary changes in this field. It has seemed obvious to him that here was the ultimate source of man's relief from drudgery. Every discovery of new power resources, every invention of new ways to generate and apply it, is very nearly a pure gain over nature. In very recent years, these gains have taken place with almost miraculous rapidity.[1]

In general all power comes from the sun. But curiously enough we learned to use it first in what seem logically the most awkward and roundabout ways—notably by releasing it from coal or oil, or by utilizing the gravity power of the water which the sun raises from the sea. Sometime we doubtless shall learn to harness sun power more directly; for the present we are confined to the more effective uses of such sources of power as are already in use. But our ingenuity in manipulating them is to a layman a constant source of wonder. The old type of industrial plant burned coal under boilers, ran central engines with steam, and distributed the power to machines over a complicated system of pulleys and belts. All this was awkward and wasteful. The more modern method is to generate electricity in gigantic central plants and to distribute it to plants throughout a district over high-voltage wires. At the plant it is stepped down to lower voltages and carried over wires to small attached motors which operate the machines.

[1] Here again those who are interested in power and its application, as a study on its own account, can only be referred to the multitudinous technical and semi-technical journals, books, and papers devoted to the subject. The developments have generated a literature little less than appalling to the layman, and far too numerous for specific reference here.

Manufacturing in the United States requires some fifty or sixty millions of horse power per year (including transportation) of which about three times as much is supplied by fuel as by water. But one of the notable modern uses of coal is for the making of electricity. Only about one-third of our electric power comes from waterfalls. But in both coal- and waterfall-produced power the efficiency of use has been greatly increased. In some twenty years power-plant engineering has nearly or quite doubled the power got from a given head of water and has increased by about 50 per cent the power got from a ton of coal.

The electrification of industry has by now progressed to the extent of between a 55 and 60 per cent completion. So widespread an adoption of this new flexible means of moving things cannot have taken place without numerous secondary results in lowered costs, improvements in quality, and a heightened morale among workers. For the new power is not only cheaper to use; it is also cleaner, more silent, and handier. On the whole the electrification of industry must be set down as one of the greatest single causes of the new industrial revolution.[1] The industry itself is only forty years old, it must be remembered; and its greatest advances are just now being made, in accordance with that rule of cumulation and acceleration which has been spoken of before. The maximum size of generating units used to be about 100 kilowatts. It is now 100,000 kilowatts. The amount of power generated in 1925 was no less than 65,800,000,000 kilowatt hours, which was 69 per cent greater than the output for 1919. As these figures are digested,

[1] Secretary Hoover would support this contention. Consult, for instance, his 1926 *Report*.

ponder a little, also, the fact that the quantity of coal used in 1925 was only 14½ per cent greater than that used in 1919, that the amount of fuel oil actually decreased, and that the amount of power generated from fuel increased 79 per cent in the same period. This is what men can do by using their heads instead of their muscles.

These great increases in efficiency were, of course, caused by the improved designing of power stations and by interconnections which enable a more unvarying load to be carried. (Demands of different plants vary with hours of the day and days of the week.) This in turn has been made possible by the research which discovered how to carry over wires 220,000 volts instead of a few thousand, with less consequent leakage and greatly reduced per-unit overhead costs.

This is the electric situation at the present time. A study of its production technique carries us very close to certain causes of our increase in productivity; we can see electric power replacing man power, doing work formerly done by humans faster and better. But this by no means exhausts the possible field of investigation. We have not yet spoken of coal, or of oil. There were a few years when enthusiasts believed the "coal age" to be rapidly passing. But so far as we can see now, water power, the one immediately available substitute, can never furnish more than a part of the power we shall need. Our attention goes back to coal. But not for the old uses. A familiar picture of industrialism is furnished by the stoker, dripping sweat from a bare torso, laboring before his flaring boilers with shovel and clinker-bar. Some of these heroic figures still exist, but automatic stokers and other machines have made it clear

that he belongs to a past age. Since we have become reconciled to the continued use of coal, we have learned how to use it better.[1] It now seems probable, for instance that liquefied coal will take the place of our rapidly disappearing stores of petroleum.

As for petroleum itself, its chief service in the efficiency movement has been to furnish fuel for automotive transport, not a slight service, as we have seen, but not one which it would pay us to dwell on further here. The point it is most important to make is that in these new ways of producing and using power,[2] one of the greatest ways to efficiency has been opened up, ways we have traveled fastest in very recent years, but ones also as yet almost unexplored.

One must necessarily be conscious, in this, as in other places, of not having dwelt upon the difficulties of a general nature which lie in the way. They are mostly of the sort spoken of before, *i. e.*, the paradoxical situation of business which produces goods for profit. Producing profits does not always mean producing goods; and there is no better illustration of the paradox than the existing state of the coal, oil, and electric power industries. These necessary goods are far too expensive because their producers are so busy seeking profits that the producing of goods suffers. All of them are semimonopolistic, in the sense of having some control over price, and all of them are fairly free of regulation—why, no one can say, in logic, in a nation which carefully regulates its railroads and

[1] One who is interested in these improvements may turn to the reports of the International Conference on Bituminous Coal held at the Carnegie Institute of Technology on November 15, and the days following, in 1926.

[2] See also for some further discussion, Chapter X of *American Economic Life.*

banks. Power, especially, is susceptible of regulation, being a recognized public utility, but anyone who knows the situation knows that the regulation does not go far enough and is not sufficiently intelligent to get the necessary results. We must learn to do this before we shall release the energy which can make us great by our own standards. To these questions we shall return later.

18. *American readiness to scrap obsolete plant and equipment.*

Accompanying the other widespread changes which have taken place in the organization of American industry there has been a growing readiness to scrap old machines and processes which, if it had not existed, would necessarily have been a considerable handicap in the attempt to achieve greater efficiency. Why this readiness exists here, and not in other countries, it is difficult to say with any certainty, but the testimony is almost universal that it does exist. We are so used to it that it becomes a matter of course, but foreign observers so invariably comment on it that one must presume it to be somewhat unique.[1]

There are plenty of instances in which whole industries have been reorganized within the space of a year or two—industries which seemed to be functioning fairly well, but which could not, with their old equipment, cut costs to the extent which seemed desirable to the new type of engineer and cost accountant.

The writer remembers reading within the last week a statement by the president of one of the largest wire

[1] *Cf.* Sir E. J. P. Benn, *The Confessions of a Capitalist*, 1925, and Bertram Austin and W. Francis Lloyd, *The Secret of High Wages*, 1925, for comments of this sort.

manufacturing concerns in the country in which he said that his company had spent an amount nearly equal to its total capital in reëquipping its plant from end to end with new machinery within the year. New financial obligations had to be incurred to do it, but he was certain of future advantages. Output, he said, had not been increased at all. That was not the objective. Already it was clear that costs had been cut enormously. The motives he adduced were themselves interesting. He attributed the necessity to the need for substituting machines for men in a restricted labor market, and for paying higher wages to the remaining employees. There also was mentioned the necessity in this particular case of meeting a certain type of competition in prices. Presumably, therefore, consumers will also benefit along with wage-earners.

These motives may be taken as rather typical if we are to believe the statements of executives who have been responsible for carrying on similar reorganizations in many industries. Frequently, faced with these necessities, the management selects entirely new sites and builds up complete units where nothing was before, because of the possibility in such a fresh start of embodying in its entirety the latest knowledge concerning location, planning, and routing, as well as completing the serialization of the machinery for production. Instances of this will occur to any reader. Most notable, perhaps, are the creations of Gary by the United States Steel Corporation and of River Rouge by the Ford Motor Company. We have already referred to the results obtained by this kind of rebeginning in textile milling.

Even when reorganization does not go so far as the complete creation of new commodities, plants are often

so internally reorganized by some such revolution as to be unrecognizable as their former selves. Scarcely any form of productive effort which still survives has been untouched by this process, whether it has been carried out partially or completely. Every industry has had to meet the situation and to do something, at least, in this direction; if for no other reason, because its position in the industrial scheme was threatened if it fell behind.

The European attitude seems to be one of careful conservation, of making things so well that they last for a very long time. We are all familiar with the fact that the American automobile, for instance, wears out in the course of five years or thereabouts, and that most foreign cars, although they cost more, are still running smoothly at the end of twenty years. The same thing is true of machinery in European plants. Americans expect to change machines before they ever wear out, and the quality of materials and workmanship which goes into them reflects this possibility. Europeans make them so well and treat them so carefully that they outlive what most Americans would regard as their period of usefulness. It seems more difficult for foreign executives to throw out a smoothly operating mechanism just because a slightly better, new one has been invented, than it does for us. This difference in attitude may partly account for our more rapid advance in per-man-hour productivity.

After all, it is a simple arithmetical problem which is involved. Will it cost more to scrap the old machine, and to buy and install a new one, than it will to keep the old one and to go on manufacturing at a slightly higher per-unit cost than would be got by reëquipping? In spite

of the seeming simplicity of the problem, the choice is often not certain. The margin of gain may be very slight and difficult to measure, but it seems to be the American idea that it is these slight gains which mount up in the total. Americans are much more willing to take whatever chance is involved. But part of the difference in attitude also may be attributed to a difference in the usual scale of production here and abroad. When there is the very large and continuous output characteristic of our largest businesses, a slight difference in per-unit costs makes a far greater aggregate difference than it does when the scale is smaller. In such a case the choice is easier to make. It is also true that the advantage is clearer when the arts of costing have advanced sufficiently far so that there can be a very definite quantitative notion of the savings possible, and when these can be reduced to figures and charts which are plain to those upon whom the responsibility for decision rests.

However it came about, it seems clear that it is characteristic of our industry to be quick to seize the advantage of newly introduced equipment. In any case, however, a word of caution is not out of place. There may be a certain weight of advantage in favor of the American system, which is worth nothing, certainly, as one among our numerous superiorities; but it would nevertheless be untrue to imply that there is a universal willingness, even in America, to throw away the old and adopt the new—that there is not still much backwardness in this as in other matters of technique here. Cost accounting of the most advanced sort, which can set out definitely the possible advantages to be attributed to any single machine or process, has not yet permeated all in-

dustry thoroughly by any means, and there is still something of the unreasoning reluctance to chance considerable sacrifice for a long-run gain which we like to think more typical of the Europeans than ourselves.

19. *Study of personnel; use of care in the processes of hiring, shifting, and promoting; introduction of fitness tests; and the rule of promotion by merit.*

Managers have always had to deal with men; but until late years they had to deal with comparatively few and without the compulsions to accuracy furnished by our new social situation. It is true, too, that good management had to wait for an increase of knowledge in the science of psychology and in the engineering attitude toward the wastage of human material. We have come quite widely to see by now that wasted motion in production is a clear and irrecoverable loss with no compensation; we have come to see, not perhaps so widely, yet quite extensively too, that unused talents are the greatest waste of all, that the stupidest of economic crimes is to give men work unsuited to their powers.

About these ideas there has grown up the technique of personnel management, which, in different degrees, consequent upon contrasting sizes and kinds of operations, has made its way into American industry. We need not go into all the stated purposes of this work,[1] but we may simply point to it as another among the possible causes for our increased efficiency. In some busi-

[1] They can be discovered by the reading of such a book as *Vocational Psychology*, by H. L. Hollingworth, 1917, or, more technically, in *Personnel Administration*, by Messrs. Ordway Tead and H. C. Metcalf, and by study of the technical journals devoted to the field. Consult also the section called "the Administration of Personnel" in L. C. Marshall, *Business Administration*, 1921.

nesses there are whole departments of personnel to whom are turned over the work of hiring, training, guiding, shifting, promoting, rewarding, penalizing, and firing its workers. Others, because they are smaller and so cannot support a whole separate department, or because they are backward for other reasons, pay less attention to the possible gains to be got by the better handling of men. On the whole, however, the extent of the work in our industry is impressive. And the results are impressive too in reduced labor turnover (always a source of serious loss), in reduced ill-health and accident rates, in better cooperation for producing, and in enlarged output, lowered costs and improved quality—none of them slight considerations.

It will be seen also that when some objective tests are devised to measure the fitness of individuals to do certain specified functions, it becomes much more likely that merit, rather than affection or dislike, will be the criterion for appointment, continuance, and promotion. What the importance of this is will be understood by anyone familiar with the ways of old-fashioned foremen in matters of hiring and firing. And how different the new methods are can be learned from studying the growing literature of testing and managing the personnel. A good short account of the procedure and difficulties may be had by reading Mr. Arthur W. Kornhauser's "Psychological Tests for Business." [1] He states the fundamentals of testing procedure as: (1) Knowing the requirements of the job; (2) choosing or devising the tests to be carried out; (3) obtaining the scores made on the se-

[1] In *The Journal of Political Economy*, xxxi, pp. 401 ff. (June, 1923), later published in book form with F. A. Kingsbury, coauthor, as *Psychological Tests in Business*.

lected tests by individuals whose ability on the job is ascertainable; (4) obtaining some measure of the ability on the job of the individuals who were tested; (5) determining the agreement existing between test scores and ability on the job; (6) setting test standards for the acceptance, rejection, or classification of applicants. All this, it will be noticed, is preliminary to selection. After selection there are, of course, all the problems which arise when jobs change in character, when promotions are to be made, and the like. It is a complicated business at best. But much depends on it. We have gone only a short way in exploiting its possibilities but its results have been immensely encouraging.

20. *Reorganization of methods of wage payment to achieve fairness and a maximum wage-incentive; and the pressure of high wage-scales and reduced hours making necessary much study of ways to cut costs beside lowering wages.*

What, exactly, constitutes fairness in wage payment no one can say generally. Fairness is a customary idea. Its interpretation in individual cases depends upon the bargain between employer and employee. And even at the conclusion of the bargaining one party or another may not feel that justice has been done. When we say, then, that wage systems aim to achieve fairness, what we mean is that they mean to arrive at an interpretation of a customary idea which will seem most reasonable to both parties and will result in as little bickering as possible. For disgruntlement is costly. No one works well who feels ill-used. After a good deal of study of the situation industrial engineers have in general arrived at three methods, of which others are variations: (1) Pay-

ment according to time worked, but with working conditions standardized, and careful records kept so that each man can know his relation to all others and can appreciate the reason for variation in time-rates among individuals; (2) payment according to piece, by which each worker's pay is proportional to his productivity; (3) a combination of these of which the most frequent is that of setting a guaranteed time wage and paying a bonus for work accomplished above a certain standard for that time.

There are many varieties of all of these devised to fit particular ways of working. They cannot here be discussed in any detail; but it may be illuminating to refer to an attempt to classify and rate about a dozen of them which Mr. A. G. Anderson of the University of Illinois has reduced to a chart.[1] A perusal of this chart will furnish some notion of the variety and differences, at least, of plans now in use.

It seems a sound enough idea that workers should be paid in proportion to accomplishment; and this would seem first to furnish approval for piece- rather than time-rates. Piece-rates have been introduced by many such large producers as the Western Electric Corporation. But not all of modern work, by any means, lends itself to the measurement of strictly individual accomplishment. Only where workers turn out definitely individualized products can piece-rates be applied. So that such concerns as the International Harvester Corporation and various automobile manufacturers have generally adopted the time-payment and group-bonus plan. And this has been done because no member of the group can possibly be isolated for the measurement of his achievement. Also, when one stops to think, he realizes that

[1] Published in *Manufacturing Industries* for July, 1926, p. 33.

COMPARISON OF CHARACTERISTICS OF VARIOUS WAGE PLANS

(Variations in Efficiency Occur with More or Less Success in Administration)

	Time Wage Plan		Piece Rate Plan														
	Unstandardized shops	Standardized shops	Unstandardized shops	Standardized shops	Premium Plans	Halsey Wage Plan	Rowan Premium Plan	Barth Premium Plan	Taylor Differential Rate	Merrick Multiple Piece Rate Plan	Gantt Task and Bonus Plan	Diemer Bonus and Premium Plan	Emerson Plan	Haynes "Miami" Plan (standardized shops)	Bedaux Plan	Reasons for excellence or its lack. Remarks.
1. Guaranteed day wages	Yes	Yes	No	Usually	Usually	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Wages level based on community standard or below
2. Incentive to maximum production by workers	Very poor	Fair to good	Poor	Excellent	Good to excellent	Fair	Fair	Fair	Excellent	Excellent	Excellent	Good	Good	Good	Good	Incentives are higher pay per unit for maximum accomplishment, all earnings for time saved; immediate reward.
3. Incentive to Achieve (or excel) a carefully predetermined task	.....	Fair	.....	Good	Good	.....	.....	.....	Excellent	Excellent	Excellent	Excellent	Good	Good	Good	Incentives are higher pay per unit if predetermined task is accomplished, all of earnings for production in excess of task; immediate reward.
4. Interest and appeal to the workers	Very poor	Good	Fair	Excellent	Good to excellent	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Excellent	Excellent	Excellent	Plans are weaker when it is difficult for workers to compute earnings, when pay not in proportion to output; and when workers do not receive all saving.
5. Effect on quality	The incentive to and attainment of quality standards is largely independent of the plan of wage payments used.															Quality is a matter of morale, supervising and inspection. Depends on character of product, upon materials, and class of workmen employed.
6. Basis of task determination	.....	Usually time study	.....	Usually time study	Usually time study	Past performance	Past performance	Past performance	Time study	Time study	Time study	Time study	Time study	Time study	Time study	Time study is recognized as the best method for setting tasks. However, they may be set fairly accurately by utilizing data supplied by machine tool makers combined with experience and judgment; on a basis of past performance; and by checking time on trial lots
7. Workers rewarded for loyalty, length of service, personality, general ability, etc., as well as output	Unlikely	Possible	Unlikely	Possible	Possible	Unlikely	Unlikely	No	No	No	Possible	Possible	Possible	Possible	Possible	When time wages are a basis for computing earnings, and individual records are kept management is in a position to reward workers on this basis. Fleet workers may be advanced to better paid tasks. The question is largely a matter of management policy.
8. Incentive to good management	No	Yes	No	Perhaps	Yes	No.	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Where standard conditions must be maintained if plan is not to fail there is incentive for good management, also where allowances are made to workers because of management's deficiencies
9. Aid in planning and work scheduling	Poor	Fair to good	Poor	Fair to good	Good to excellent	Poor	Poor	Poor	Good	Good	Good	Good	Fair	Excellent	Excellent	The Haynes and Bedaux plans assign work on a basis of measured capacity to produce which is an aid to work scheduling. The other systems rated "Good" tend to stabilize output at fairly high levels.
10. Pay roll computation	Simple	Simple	Fairly simple	Fairly simple	Complex	Complex	Very complex	Complex	Complex	Very complex	Complex	Complex	Very complex	Fairly simple	Fairly simple	Computation of payrolls with Emerson and Merrick plan may be greatly simplified by using prepared tables and slide rules.
11. Estimating labor cost in advance	Very poor	Good	Excellent	Excellent	Good to excellent	Poor	Poor	Poor	Good	Good	Excellent	Good	Fair	Excellent	Excellent	Known costs per unit of production and plans which have a steadying effect on volume of output aid in accurately estimating labor costs.
12. Estimating overhead cost in advance	Very poor	Fair to good	Very poor	Fair to good	Good	Poor	Poor	Poor	Good	Good	Good	Good	Fair	Excellent	Excellent	Definiteness of output facilitates estimating overhead.
13. Favorable to beginners and mediocre workers	Yes	Yes	No	Perhaps	No	Yes	Yes	Sometimes	No	No	No	No	Yes	No	No	Time wage plans inevitably favor the mediocre worker, as do incentive schemes based on past performance. In the latter case there is usually opportunity to accomplish considerably more than past performances indicate. In the Emerson plan the standard set is lower than usual. Piece work in standardized shops with a guaranteed day rate favors the beginner and mediocre worker.
14. Production cost averages	High	Fair to low	Fair to high	Low	Fairly low to low	Fairly high	Fairly high	Fairly high	Low	Low	Low	Fairly low	Fairly high	Fairly low	Fairly low	Assured day wages tend to lower incentive for high production rates; while extra reward for task accomplishment tends to increase it. Costs will be lower in standardized shops.

where serialization has been carried very far, the group is inextricably welded together.

On the whole, it will be seen, no one universal best way of rewarding effort exists, and industrialists are right in making adaptations to fit peculiar situations. The one important concern is that there should be accurate measure of accomplishment allocated as closely as is possible to individuals or to groups, and wages somehow made proportional to achievement. This is the most that can be done by wage devices. For, after all, these devices do not touch the main problem at issue, which is whether wages ought to be higher or lower. They do, however, when they are carefully worked out, eliminate much ill-feeling concerning the relation of wages to product. And this is important.

Wage devices have been so generally introduced, at least in large industries, that they have begun to center attention on the other and more important problem of generally higher wages.[1] For many years organized labor was successful in limiting output and in opposing the introduction of efficiency schemes which would increase it. This was done largely on the theory that the more work there was done, the less there remained to do. This idea has gradually been abandoned in favor of the more rational one that the way to raise wages is to make output greater. The American Federation of Labor has officially declared this to be its aim.[2] But, also, along with this concession to the efficiency movement, organized labor has declared its purpose to use

[1] The most successful treatment of this problem, in the modern manner, is that of W. H. Hamilton and Stacy May, *The Control of Wages*, 1923.

[2] In the now famous Atlantic City declaration of 1925.

every means it possesses to obtain for itself, rather than for shareholders, the gains made by the new efficiencies. This is no idle threat. As labor becomes relatively more scarce it is finding itself in a superior bargaining situation and employers are forced to make more concessions. Wages are rising proportionately to other incomes. This is more generally true, of course, of the most advanced industries where efficiencies are being most rapidly introduced. This is again one of those situations in which it is difficult to say which is cause and which effect. Because efficiency is greater, wages can be higher; because wages must be higher, efficiency must be increased. But given the start, given some knowledge of ways in which efficiency can be increased, the pressure for higher wages can result in the more rapid introduction of other ways to reduce costs. It was not so long ago that business extremities, in which lower costs were pressingly necessary, invariably engendered a movement for the reduction of wages. As a result of the whole change in this matter general reductions in wages are hardly ever talked of any more. There is a surprising spread of the idea that reducing wages is the easiest way to cut off an important part of the market; and lowered incomes anywhere in the community are viewed by business men with an alarm which is in great contrast with earlier attitudes. This is by no means universal; older notions still survive but they seem to grow less and less important. In this it seems possible that the widening of the modern scale of business may have operated. For, as businesses grow greater, it is more and more apparent that workers and consumers are identical—a fact which is not true of the small-scale business which sells to the workers of other employers.

21. *The spread of various schemes for increasing the welfare of employees at work, and for increasing democracy in control.*

There have also been differences of opinion between workers and managers concerning various schemes to increase the welfare of workers. Managers have felt that welfare work helped to discharge certain of their obligations to workers, also, undoubtedly, that it was one of those arrangements which, in the long run, would pay in increased morale. Workers have been inclined to contend that an employer who had funds to spend in welfare work might use them for raising wages; and that if this were done workers could well take care of their own needs. In spite of this rather widespread feeling among employees, welfare schemes have attained rather impressive proportions by now. On the whole it seems that they must have contributed something to our efficiency.[1]

Welfare work is a term which covers an enormous number of different activities; in general, however, it refers to the bettering of conditions of life for workers, apart from the job. It may mean, in one employer's mind, the furnishing of free lunches, the provision of athletic fields and equipment, or recreation centers of various kinds; to another's view it may involve old-age pensions, a visiting nurse or other health services,[2] or, even, the building of community homes. All these have been provided in a considerable number of cases. Most of them must be set down as really furnishing a con-

[1] English experience is detailed in *Welfare Work in Industry*, edited by E. T. Kelly, 1925, although "welfare work" abroad is also used to describe much of what we know as personnel work.

[2] *Cf. Health Maintenance in Industry*, by J. D. Hackett, 1925.

tribution toward higher standards of living, though there have been instances in which what was done was obviously an attempt to force upon workers the particular religious or moral ideas of the employer. It is probably these latter which have caused most of the arguments centering in the ethics of paternalism.

We have no concern here with the question of the fairness or moral results of various welfare schemes. We have simply to recognize that any source from which the provision of higher living standards comes must be one which contributes to efficiency. Further than this it is difficult to go in a field where intangibles such as these are involved. For, necessarily, the results in productivity would be indirect, occurring as a result of the increase of human energy, heightened *esprit de corps*, and a greater feeling of security. If there were scope here, something might be done in discriminating among certain specific schemes as to the contributions they make.[1] But for our purpose it is sufficient to note the prevalence and variety of current experiments and their possible relationship to the efficiency movement.

Concerning what is usually called "industrial democracy" we must come to almost the same conclusion. First let us say that the term means the respresentation of workers in management, or, perhaps more accurately, a wider spread among members of the pro-

[1] The policy of the Oneida Community Ltd. at Oneida, N. Y., is one of the happiest achievements yet arrived at under our system. Its success commends it to the study of anyone interested in bettering industrial affairs. Miss Esther Lowenthal writes of it with a command of language and incident all too infrequent in economic literature in *The Journal of Political Economy*, xxxv, pp. 114 ff. (February, 1927). There is, of course, at Oneida, a special heritage and a well-developed attitude which do not exist in most industrial situations. But much can be learned from it.

ducing group of the functions of control. There are many varieties of this general movement. Mr. W. J. Lauck digests eighty of them [1] which range all the way from a limited participation in profits to the control of management. Of all of them, in Mr. Lauck's view, only five have any very great significance. These are those of Wm. S. Filene Sons of Boston, the Dutchess Bleacheries of Wappinger's Falls, the Dennison Manufacturing Company of Massachusetts, the A. Nash Company of Cincinnati, and the Philadelphia Rapid Transit Company. None of these is among the largest of our industries. In view of this it is difficult to assign any great significance to the industrial democracy movement as a causal factor in our growth of efficiency so far. In these special cases, and in some others of a more limited extent, there seems to be revealed the promise of something to come in the future which will strengthen the foundations of our whole industrial life. But the movement can hardly be said to have gone sufficiently far as yet to have accomplished much.

22. *The tendency of unions to organize on an industrial basis; and the interest of unions in better management as one way to raise wages.*

The historic forms of labor association are dominated by the idea of like interests among members of the same craft. This was once a very pervasive bond. But with the changes in the organization of production it has ceased to have anything like the universal appeal it once possessed. It is much less important to one who is a

[1] In the appendix to his book, *Political and Industrial Democracy, 1776–1926*, 1926. *Cf.* also Ben M. Selekman, *Sharing Management with the Workers* (Russell Sage Foundation publications), 1924, a careful account of the Dutchess Bleacheries experiment.

molder, for instance, that there should exist an organization of all the molders in the country, than that he should be associated with all those who are working with him in the making of the product, whatever it may be. Thus there has been a gradual breaking down of craft organization for purely practical and selfish reasons. And into the place of craft associations there have been growing forms of association intended to meet the employer on his own ground and with an organization corollary to his own.[1]

This change is very gradual and has not as yet gone far enough, even, so that one can be certain of the type of organization which will replace the older one. There is the resistance, too, of the old, well-organized craft unions to any such change, which has served to hinder reorganization. The arguments for and against industrial unionism are too familiar to deserve repetition here. It is simply desired to record a strong impression that alongside and through craft unionism, and in spite of opposition from conservative labor leaders, organization on an industrial basis is making steady headway. One might use the illustration of the printing trades or of the railway brotherhoods to show how ostensible craft unions are in reality, and in action, in-

[1] There must necessarily be a large element of opinion in any such generalization as this. The reader who cares to make up his own mind will find literally libraries full of material. He might do worse than to start with a book, no longer recent, but still valuable, R. F. Hoxie's *Trade Unionism in the United States*, 1917 (revised in 1920). For collections of excerpts, excellent in their way, see Douglas, Hitchcock, and Atkins, *The Worker in Modern Economic Society*, 1923, and Atkins and Lasswell, *Labor Attitudes and Problems*, 1924. Solomon Bloom's excellent *Labor Economics* is careful and trustworthy, sometimes profound. Mary Beard's *The American Labor Movement*, 1920, is a readable, but very brief history.

dustrial. Out-and-out industrial unions have time and again demonstrated their power: the clothing workers and the miners need only be named to recall their strength in action.

It is not the purpose here to argue this point, but to assume it, if that is not too inaccurate, and to call attention to the influence of industrial unionism in our American productive achievement. But even outright industrial union organization is not necessary. Obviously before this can happen workers' minds must become used to the idea that all those who help to make a product are coöperating in a more real sense than two riveters are, one of whom works in St. Louis and another in Seattle. Also that if there is a question of bargaining for wages, those wages come out of no general fund but out of the gross return from the sale of a specific product. Wages are determined in goods markets before they are in labor markets. Unless workers are frankly resigned to exploiting each other, no group of them can get more than is contributed by them, with the help of management, machines, and power, to the gross product of the industry. The effect of craft unionism is frequently to cause a little group of one craft, in an industrial organization, to get so high a wage as to lower the wages of the other workers in the same plant, an injustice which rankles. Sometimes, in this way, the organized workers of an industrial unit may exploit the unorganized ones. But this, again, is aside from the main point, which is that when workers become resigned to throwing in their lot with their fellows on a job, there is a chance for the functioning of the idea that wages cannot be higher than returns from sales; that, indeed, with good "shop" organization, as it is

called, they may be able to set up a continuing relationship between the concern's returns and their own wages. When this idea begins to make way and begins to be enforced, there comes to be a real interest in productivity among the workers themselves which was before confined to managers and owners.

No one is in a position to say, probably, at the present time, to what extent this new idea has made its way into workers' minds. But, judging from some external evidences, it has gone pretty far. One might point to the company union movement, except that we know most of this development to be a forced growth, fostered by employers with the notion of emasculating labor organization.[1] Regardless of the motive for its introduction, however, it may have salutary effects and workers do not seem to have suffered as great disabilities under it as were predicted by its opponents. Of course the desirable result, from the social point of view, is that all who are engaged in making goods should make such arrangements among themselves that withholding of effort would not any longer seem to them attractive. The way to engender some enthusiasm for product in workers is obviously to establish a relationship between what they do and their reward for doing it. How far we have gone toward eliminating sabotage is what we cannot tell. Whether the official attitude of the American Federation of Labor is a reflection of the general mind of labor, or of the wish of employer-minded leaders, one cannot say. But for what it is worth, the At-

[1] For a clear and cautious discussion of the place of company unions in the industrial field see H. R. Seager: "Company Unions vs. Trade Unions" in *American Economic Review*, xiii, pp. 1–14 (March, 1923). For a spirited argument pro and con—mostly con—consult Section III, pp. 96 ff. in *New Tactics in Social Conflict*, 1926.

lantic City declaration may be cited, which was, in brief, an affirmation that labor intended thenceforth to cooperate with management in getting greater efficiency, but that also it expected this greater efficiency to result in increased wages.[1]

Aside from any external evidences of this sort there are one or two considerations which seem pertinent in this matter. It cannot be proved here that there has been a wholesale change of attitude concerning work. But a good deal of observation leads one to believe that there has been some change. And this may have been in strategic places. Also, it may be worth noting that serialization has reduced the number of hand workers proportionately to output, and that better education and raised standards of living have tended to reduce craft or even class consciousness. All these seem to work together to bring about a mitigation of the conflict between employer and employee, which, in its bitterest phases, made any kind but the most grudging coöperation impossible. Also there may be something of the same result coming from the change in corporate structure. Managers are not nowadays characteristically owners. They may be growing toward a feeling of identity of interests between themselves and their workers rather than between themselves and their owners. It is not impossible also that workers perceive this change in the traditional line-up. The whole point to be made is that there may be changes taking place in corporate structure, in technical organization, and in workers' attitudes, which make workers more willing, on the one

[1] The so-called "B. and O. Plan" is the living illustration of this idea in action. Its results are being rather proudly pointed to by all concerned, workers and employers alike.

hand, to coöperate in increasing their own productivity,[1] and less able, on the other hand, to prevent their productivity from increasing even if they should desire to do so.

[1] One who is interested in the most significant experiment yet made in industrial relations will want to investigate the "B. and O. Plan." The February, 1926, issue of the *Bulletin of the Taylor Society* was devoted to "Union-Management Coöperation in the Railroad Industry." This very phrase is significant of a deep change in attitude not only by management but also by unionized workers. The content of this new coöperative venture is even more startling to one who is used to the conventional description of relations in industry. In the *Bulletin*, Mr. O. H. Beyer writes on "The Technique of Coöperation," and in a preliminary statement lays down seven requirements for successful coöperation:

1. Full and cordial recognition of the standard unions as the accredited agents to represent railroad employees with management.
2. Acceptance, by the management, of the standard unions as helpful, necessary, and constructive in the conduct of the industry.
3. Development between unions and management of written agreements governing wages, working conditions, and the prompt and orderly adjustment of disputes.
4. Systematic coöperation between unions and management for improved service and the elimination of waste.
5. Stabilization of employment.
6. Measuring, visualizing, and sharing fairly the gains of cooperation.
7. Perfection of joint union-management, administrative machinery to promote coöperative effort.

CHAPTER V

BARRIERS TO PRODUCTIVITY

1. *The persistence of depressions.*

As we have gone through our list of developments which seemed to contribute to the increase of productivity, we have taken occasion, from time to time, to refer to their possible unfavorable aspects. This was done, it will be remembered, in the case of consumption changes and in some others. It seemed best, however, for the sake of clarity in presentation, to omit most of these drawbacks there, since, after all, we were then trying to account for an increase in productivity, rather than trying to understand why it has not been greater than it has. A natural reluctance to leave the matter at that, however, will be understood. This is not the best of all possible worlds; at least industry is not the best of all possible industries. And although we may justify an interest in considering its more favorable aspects, we have also, here, an admitted interest in industry's coming of age, an adulthood which can only be reached when childish traits are laid aside as outgrown. Our purpose would be defeated if we did not give more attention than we hitherto have to some aspects of our situation which are not so hopeful. This brief section has therefore been set aside for that use.

Some of these difficulties have already been mentioned; some others, though they are a matter of familiar knowledge, and are frequently discussed, have not. Such,

for instance, are the admitted ugliness of industrialism, the pressures upon the individual of a highly mechanized and standardized routine of work and play, the ultra-conservatism of the possessing classes who frankly prefer the maintenance of their position to any risky experimentation with industrial forces, the corruptions which exist within industry, recognized but condoned by almost every insider, which make possible, for instance, the exploitation of a corporation by "inside groups" as well as many other practices not to be defended by even the low standards of business men, the red tape which is the reverse of the favorable picture which has been drawn of operations carried on on a large scale, and that much-discussed paradox that making money does not necessarily involve making goods. These and numerous others might be exploited here at length, if that had not been done in other places.[1] All these, however, we shall deliberately neglect in this book.

[1] I would, for instance, refer my readers to Sidney and Beatrice Webb, *The Decay of Capitalist Civilization*, 1923; Bertrand and Dora Russell, *The Prospects of Industrial Civilization*, 1923; various works of Thorstein Veblen, such as *The Engineers and the Price System*, *The Theory of the Leisure Class*, *The Theory of Business Enterprise*, *The Vested Interests and the State of the Industrial Arts*, and *Absentee Ownership;* John A. Fitch, *The Causes of Labor Unrest*, 1924; various works of Scott Nearing, Stuart Chase and John A. Hobson; the publications of the Fabian Society; R. H. Tawney, *The Acquisitive Society*, 1920; A. B. Wolfe, *Conservatism, Radicalism, and Scientific Method*, 1924; the criticisms of the socialist and labor press in the United States and abroad; and even those of such liberal journals as *The Nation* and *The New Republic*. A much more extended list will occur to any person who is casually oriented in the general literature of our time. Think for instance of the general tenor of the novels of Sinclair Lewis, Zona Gale, Theodore Dreiser, Sherwood Anderson, and the essays of Lewis Mumford, Edmund Wilson, and other literary folk. The critical analyses of these last may be general rather than specific, but they are sufficiently emphatic. Industrialism has, in-

The first unfavorable situation to which we shall give some attention is the patent fact that depressions continue to recur. They seem, however, to lessen in extent. As to this, the authorities, it must be admitted, differ. But at any rate, some of their worst effects may, with more confidence, be said to have been mitigated. In spite of this it has to be recognized that they continue to be the greatest aggregate drag upon our progress. Of course they are, themselves, complexes of phenomena and so not subject to casual analysis. We must be content, therefore, here to call attention to the persistence of this great sign of disequilibrium and to the lack of any positive control.[1]

Great shifts in price levels sweeping through the whole world of business often upset the best laid plans of engineers and executives. Their constant imminence necessitates a preparedness which is costly just as the imminence of war involves costs to the nations which must be prepared for it—this in addition to the costs involved in the actual arrival of disaster. Looked at in the gross, we can understand that these great cycles are a function of the dynamic nature of our system. We do not know where we are going; we have no plan toward which we work. Such a plan may in time come about by being built upon the smaller plans industries

deed, few defenders except among the economists who never have been able to separate reality from traditional myth, have indeed never taken a good look at the world. The author, indeed, considers himself unique in attempting to discover tendencies worth extending and bringing to maturity.

[1] Readers are invited to invade this fascinating field of study in which such strenuous pioneer work has been done by W. C. Mitchell and his colleagues of the National Bureau of Economic Research. Their publications are available anywhere. See, particularly, Mr. Mitchell's magnificent *Business Cycles*, revised in 1927.

are beginning to make for themselves. When every industry shall have attained a definite program for a future period, it seems possible that some inter-industrial body may be set up to formulate a general plan. But this is in some far future. We carry on now by producing in anticipation of demand. Consumers expect to find the goods they need ready to be taken from the stocks of retail establishments when they want them. Even industries themselves, which consume the products of other industries, expect to buy at "spot." A system of contractual relations which extended a network over the whole productive process from its beginning to its end might eliminate this risk. But we are far from this at present; [1] and it seems unthinkable that such a contractual system would ever be participated in by the ultimate consumer. Who is willing to say when he will buy his next pair of shoes, when he will require his next journey to the tropics, and what his diet will be during the January of next year? Of course, even if the contractual system did not extend to ultimate consumers, but did extend widely throughout the business field, all but a slight margin of uncertainty might be stabilized. Then, too, we might make very great advances in forecasting probable demands which would cut that margin down.

Even if all this happened, however, could we depend upon nature to give us steady crops? Upon the value of money to remain steady? Upon basic inventions not to upset our best calculations? These are the great remaining uncertainties. We might, of course, by a system of storages, stabilize the flow of raw materials

[1] The prevalence in some interlocking trades of "backbone" orders may be a beginning.

even if nature refused her steady coöperation; we might stabilize the value of money in the way Mr. Irving Fisher suggests, or in some other way; and we might confine the disturbing power of inventions by putting them into use without allowing the product to total more than it did before, at least until other adjustments could be made. If we could accomplish all this, we might eliminate depressions. But when may we expect to have become so mature?

In the meantime we flounder. The industrial system is like a ship with plenty of power but with no rudder, no compass, and no captain. It wallows haphazard upon the sea of human experience. But this metaphor is inadequate unless we expand the picture of a ship to Gargantuan dimensions and free it from the usual visual limitations. It is a ghostly Flying Dutchman which carries us all, from which there is no escape, yet which we cannot define because we cannot see it whole, which we cannot guide because we have not yet invented compass, sextant, or rudder, and whose crew we cannot control because we lack the idea of discipline.

2. *Weak spots even in good times, as in agriculture, coal mining, and the textile trades.*

But we do have periods when a detached observer would be completely fooled. We act as though we knew where we were going. There seems to be a precision and accuracy of concatenated rhythms which makes the whole look, for the moment, precisely like a machine. Of course this is an hallucination. What is happening is that we are climbing one of those hills we are so familiar with from the charts of the cyclists. Rhythms do not synchronize so well as they seem to do. This goes

too fast; that too slow. But consumers, because money is easy to get, do not just then object to high prices for the goods which are scarce; and middlemen do not object to the gradual filling of warehouses with goods of which too many are being made. In time, however, money will become scarce and buying will slow up. Warehouses will suddenly be discovered to be dangerously full of certain things. It will be realized, all at once, that if we had worked a little harder at making the things for which people were paying too high prices and so brought the prices down, and if we had worked a little less hard at making the things which they were not disposed to buy in so great quantities and so raised the prices, we might have kept on. But as things are, something has to be done. We are at the crisis.

But even when the whole industrial system seems to be humming with varied activities all working smoothly together, people who are informed know that there are in it certain slow, dragging, units, out of tune with the rest. These vary from time to time, but there are certain of them which, for many years, have been more likely than others to cause trouble. These are, among others less important, coal mining, textile manufacturing, and agriculture. Each of them labors under certain handicaps which hold it back. In coal mining the difficulties have partly to do with poor business technique. Organization of the industry has not gone forward toward combination and the development of a general plan for the industry so rapidly as it has in other fields. Textile manufacturing, also overconservative in plant modernization and in coördination, has been suffering from having established itself early in New England and of being under the necessity lately of moving into the South.

Agriculture, most important of all because it furnishes raw materials, has failed lamentably to progress in the modern way and has suffered the penalties of the usual lamb in trying to lie down with lions.[1]

Industries such as these, which, for some reason, have failed to keep up with general advance, and which are yet vitally necessary in our whole scheme of things are a constant source of irritation. In agriculture, for instance, 25 or 30 millions of people are involved. When their efforts in production are relatively ineffective, when they are forced to sell at low prices and buy at high ones because of disadvantages in the market, and when their incomes and living standards are low, they form a stagnant social group which ultimately affects all other groups. The results are seen not only in economic life, where their energies are characteristically spent in trying ineffectually to raise prices instead of to cut costs as other industries do, but also in social life where they exhibit a backwardness in morals and thought which appalls and disgusts the rest of mankind. It is no accident, for instance, that rural States raised the anti-evolution issue fifty years after public opinion elsewhere had conceded the point. And it seems obvious that this is only a symptom of an economic backwardness which must be cured before progress of other sorts can be expected.

Here again is a place, possibly, where social control can be of service. It illustrates the truism that in so

[1] For a discussion of the difficulties of the coal industry see Hamilton and Wright: *The Case of Bituminous Coal*, 1925; also Hunt, Tryon, and Willits; *What the Coal Commission Found*, 1925. Agriculture and its economic problem were discussed by the author in "The Agricultural Problem," in the *Political Science Quarterly*, xxxix, pp. 549–591 (December, 1924).

closely coupled a system as ours, all of us have to advance together or we cannot advance at all. We may as well resign ourselves to reaching a firm but helping hand to backward industries, provided of course that they are essential ones. But we go at it in wrong ways. In agriculture, for instance, we allow the farm-bloc in Congress, which has an artificial strength because of our rotten-borough system, to impose legislation for the artificial control of prices, instead of recognizing that what is needed is to make the industry more efficient in the technique of production. But this is also true of other weak industries, and the farmers are quite justified in arguing that if manufacturers are to be allowed prices arbitrarily raised by tariffs, they ought to have their own prices raised somehow.[1] Perhaps the Republican party will, in time, come to see this point, and to abandon its high-tariff policy for one which fosters all industries by direct means, rather than a few by subterfuge, and those few the ones which need it least.

3. *The conservatism of education: the inculcation of past standards rather than the freeing and training of intelligence and the slowness of the enlargement of educational programs; the conservatism, also, of the highly trained technician, and of others whose education has served to fix rather than free imaginations.*

In a section on the causes of productivity, the contributions of education were spoken of, but there is something still to be said on the other side. For education, as it works practically, can obstruct as well as

[1] See the McNary-Haugen Bill which can be had by applying to the Superintendent of Documents in Washington. A short article in *The Nation* for June 15, 1927, discusses its main features and its real difficulties.

contribute. Two phases of our American system have to be entered in the debit column: one is the slowness with which the technical arts are admitted to both lower and higher education; the other is the adherence of teachers to the antisocial ideals of what Mr. A. B. Wolfe calls the "interested conservatives." [1]

We have a persistent idea that all people should be equal, an idea which was, in its origin, a theory of political rights. We still feel that all people should have equal rights, but we confine our notion of them to political ones, and we educate children as though, if their political careers were protected, they would, in fact, be equal with one another. This is an age when economic, rather than political, rights need assertion and protection. The idea of equality has in fact crept into the educational system under a slightly different guise: that all children are potentially *alike* and ought, therefore, to be given the same training. But this is not the worst of it. When we say that all children are alike, it leads us to educate them as though they were all to be gentlemen and ladies of leisure to whom the margin of life is its most important part. We neglect to teach them how to contribute anything to our culture in their main business of working. There is a good deal of truth in the criticism which has been made of our educational system, that we not only do not train children to live, but that we actually try to train them in ways which unfit them to live. Education rightly conceived, one would think, ought to make people better fitted to cope with the problems they will certainly have to face, but anyone who conceives our educational program in these terms has only to think

[1] In his *Conservatism, Radicalism, and Scientific Method*, New York, 1923.

back seriously over his own schooling to understand how mistaken this is and how far short we characteristically come.

The consequence of this is that all the real business of life has to be learned outside the schoolroom. Teachers miss their greatest opportunity when they conform to the usual curriculum. And children come to their contacts with industry woefully unprepared by their schooling for the difficulties of that life. It is true that, in the United States, we have a certain number of technical schools, but it is only a very few of those who enter the primary grades who ever come into contact with technical training at all, whereas about 90 per cent of all pupils would be better prepared for life and would take their education more gracefully if it came to them through the technical arts. Of course, this outright technical training would have its own difficulties, too, for it is very difficult to generalize specialized education so that more than one technique is imparted, a neglect of some of the child's potential capacities which is certainly to be deplored. This kind of training may shut him off from the kind of work which he is best fitted by nature to do. In spite of this difficulty, however, the most normal approach to adult life is through some kind of practical education of this sort, out of which the child can grow normally into his real business of living, and the best technical schools are meeting the problem in fairly successful ways.

It does not require a highly specialized technical school to operate in this way, however. Experimental schools of the Horace Mann (N. Y.) type begin at the very earliest ages to use what is called the "project method" and to furnish the children with the necessary

instruments for the solution of problems which are intended to lead the child normally into contact with the real problems of life as he grows older. This is generalized technical training at its best. Judging from the preponderance of opinion among educational leaders that this kind of training is the best one, we may expect, it would seem, a greater and greater development toward it as the new ideal; but we fall far short of it at the present time. Most of our schools are devoted to rote learning and to a curriculum which is intended to lead children successfully into our backward liberal arts colleges with their antiquated standards and programs rather than into the kinds of higher education which would fit them to meet the problems of modern life, especially those set by the development of industrial technique.

The other great difficulty is that teachers are so apt to misuse their positions of authority to indoctrinate children with peculiar ideals in politics, economics, and all other controversial fields in which it is particularly important that new generations should have open rather than closed minds. Most college teachers who come into contact with freshmen, for instance, acknowledge that their first business is that of breaking through the crust of doctrines which young men and women have developed from their primary and secondary school training. Young men and women characteristically come to college with very neat and well articulated ideas concerning everything. They are not fitted to learn anything more until this system of ideas can be completely broken up and their minds again made amenable to the scientific approach to problems. College teachers come ultimately to feel that the training children get

from their secondary education is more of a handicap than a help in going forward into the fields of higher learning, and frequently find themselves wishing that teachers in the secondary schools would discover that their business is not to inculcate doctrines but to help in developing a certain technique of learning which would free the minds of youth to range forward into unexplored fields of knowledge.

Doubtless this major difficulty in our school system comes about through the fact that teachers are not permitted to do as they like but are forced to conform not only to certain curricula but to the system of ideals which prevails in the community—ideals which are apt to be those of the past rather than those of the present or future, and which close students' minds rather than help to open them. Naturally, also, these ideas are molded by the economically superior group to whom others look up. There is a related difficulty also which might be mentioned among these others. This is the fact that even when a student wins through to a genuine technical education and acquires the tools of a special craft in engineering, medicine, law, or any other field, he has by this time learned to be experimental in his own field, but dogmatic about the fields into which he is not thrown. The less we know about any craft, the more certain we seem to be of how it ought to be carried on and what its results ought to be. Literary men are apt to have very definite ideas about the medical profession. Engineers are very certain about the proper political organization. Physicians have definite ideas concerning industrial technique. And naturally, all these lay doctrines are apt to be irrelevant and pernicious in proportion to the certainty of their right-

ness which prevails in the minds of those who hold them. One might think that training in a technique would teach the technician to leave other techniques to experts, but this is a lesson which never seems to be learned.

A great part of opposition to progress in special fields comes, therefore, not from uneducated people but from the most highly educated ones. This is a problem, the solution of which is very difficult to envisage, but it is worth speaking of among the very definite barriers to progress. The bearing of all this upon advances in industrial technique is immediate. Conservatism in education leads to the training of children for life in a society which is pre-industrial and so engenders a resentment among educated people against the kind of culture which industrialism develops, and serves to foster the notion that industry is the enemy rather than the servant of the good life. In its extreme form, it leads people to give only a grudging service to industrial society and to adhere to other than modern ideals. Until educators learn that their training must lead growing generations toward the acceptance of reality, we shall not cope successfully with the problem of making present reality into a better future; and until teachers learn that their real function is that of training minds rather than inculcating moral systems, we shall not be able to develop new moral systems which are better than the old.

4. *Our low standard of living, which still permits poverty to characterize large sections of the population.*

One is always handicapped in talking about the American standard of living as being lower than it ought to be, because it is so obviously higher than it ever was

before, or than it is at present in any other part of the world. What has to be done is to compare even our present high standard with one which would be of the sort any person with common sense would desire. A generous section of *American Economic Life* was devoted to the problem of poverty, and the attempt will not be made to discuss it in any detail here. One must call attention to the fact, however, that about 86 per cent of Americans still are members of families whose incomes are less than $2,000 a year, a sum which can be lived on by the average family of five only by the sacrifice of most of the amenities, and even some of the necessities of life, which would be included in any standard of living calculated to produce conditions of ordinary health and welfare.

So long as this low standard of living prevails, the fully developed energies of men cannot be turned either to the uses of leisure or those of production and our industrial progress is necessarily handicapped. This disease, in a sense, will cure itself, for as productivity arises and incomes become greater, poverty will become less; but it will obviously not become less without such an apportionment of incomes as will specifically devote rising productivity to the amelioration of poverty and such a betterment in our ways of consuming as will make the best use of the incomes which are received. So that in considering the problem of poverty, we have to take account of those forces in society which make for inequalities in the apportionment of incomes and for unwise uses of them. These problems also were developed in *American Economic Life* so extensively as to make discussion unnecessary here. The desire has simply been to call attention to the facts and to the dif-

ficulties which have been imposed upon our program for increased productivity.

5. *The handicaps of transition.*

Another of the very definite handicaps under which we operate as we move toward greater efficiency is the incompleteness at present of the fulfillment of the technical program. A considerable part of this is caused, if a general cause can be assigned at all, to our attempt to operate under an antiquated system of competition. The epitaph of laissez faire has been written prematurely.[1] Doubtless we move very rapidly toward the era of combination, voluntary coördination, and better organized social control, the beginnings of which were assigned as one cause of our present efficiency in earlier sections. But this new day can hardly be said to be well begun as yet. In most men's minds business is a private affair still, in which volunteering for industrial activity is assumed and which depends upon conflict among various forces to bring about stability as well as a measure of social justice. The result is that we tolerate and even foster business organizations which we know to be inefficient, we fail to complete continuous processes and serializations because we hesitate to interfere with the precious principle of privacy in business, we overdevelop some phases of production and emasculate others, and we administer our social control on the theory of conflict.

To change all this requires a reorganization of thought as well as of technique. We need a new economics which presents a clear picture of the trends taken by our progress rather than one which organizes the facts of in-

[1] *Cf.*, for instance, Mr. J. M. Keynes' *Laissez-Faire and Communism*, 1926.

dustrial life about the concepts of nineteenth-century writers.[1] Unquestionably the dominant strain in economic thinking is still based upon the old order rather than the new. It is not strange, in consequence, that even college men, who go out to business, still think in the terms of a competitive rather than a coöperative system.[2] Statesmen, business men, even engineers have no clear notion of what is implied by the very developments in which they play the active rôles. The responsibility for this backwardness in thought, which reflects itself in definite handicaps to progress is mostly that of economists, especially those who are teachers. For it is teachers who shape the ideas of those who afterward operate our system and control it.

[1] Mr. L. K. Frank is one of those few who are making an honest effort to approach a new theory. See, for instance, his "Significance of Industrial Integration" in *The Journal of Political Economy*, xxxiii, pp. 179 ff. (April, 1925). He sees in integration of a voluntary sort the kind of a unified system I have tried to foreshadow here: "The growth of integrated industry is much more than an industrial development; it is the continued sweep of the industrial revolution . . . fulfilling that great change. . . . Viewed with a little perspective it is not so much a new departure as a return to the unified direction and control of production which preceded machine industry." He recognizes the difficulties which beset an industry run by business for the usual rewards, but forecasts the disappearance of most of our business apparatus. He may be right. *Cf.* also L. D. Edie's "Some Positive Contributions of the Institutional Concept," *Quarterly Journal of Economics*, xli, pp. 405–40 (May, 1927).

[2] An illuminating but inconclusive experiment in coöperative and controlled industry was carried on in the United States during the war, with the War Industries Board, the Food and Fuel Administrations, and the Price Fixing Committee playing major rôles. A short analysis of the situation by the present writer appeared in *The Nation* for April 6, 1927. A crucial question in all this is, of course, the real forms of the "new competition" which have to be met by control. On this point read Stuart Chase in *New Tactics in Social Conflict*, 1926.

But all of these are the handicaps of transition. Technicians stumblingly, and without any clear notion of what, in general, they are doing, make progress toward efficiency. Haltingly and without knowing quite why, statesmen give up the attempt to repress developments toward a coördinated industrial structure and go over to the encouragement of them. Economists discover slowly that things happening under their noses are more worth thinking about than their rather moldy inheritance of doctrines. I should even be willing to say that there grows slowly into men's minds the idea that rights must be economic rather than predominantly political and that the protection of living standards is perhaps the most important single item in a generally reorganized system of social ideals. All this happens with discouraging slowness. The crusts of thought are hard to break. But this need not extinguish an enthusiasm for the ends involved, nor quiet the activity of those who work for them.

CHAPTER VI

INDUSTRY'S MATURITY

1. *Some practical suggestions for increasing productivity.*

Have we, in turning over and over the idea of progress in industry, in mentioning all the likely suggestions of causes, penetrated to the secret of efficiency? One of the clear results of any study of this kind seems to be that, when all the facts are turned up, there is no secret. Certainly no one knows anything which everyone cannot know who troubles to discover, even in the most casual fashion, what is going on. It is all there, in books, in trade journals, in government reports, in reports of the proceedings of scientific meetings. But this is not the question most people ask. They want to know what are the most important factors in causing efficiency. But here again it seems difficult to say that one is more important than another. If any one of our enumerated instruments or processes could be dropped out of industrial practice for a time and all the others could be maintained as constants, or if any of them could be introduced singly under controlled conditions, we should have the kind of a result which scientists would recognize as definitive and final. That we cannot have. And lacking it, it is hard to see how anyone can say certainly that one is more important than another.

It is difficult to see how one intrusted with a share in the managing of society, an industry, or a business, could feel justified in dispensing with any of the prac-

tices we have briefly surveyed. Our American efficiency, as a general phenomenon, seems to be the result of a complex of instruments and processes within industry, working together, and jointly interdependent, as well as a complex of social arrangements which have furnished a generally favorable medium for their development. It would seem inevitable, therefore, that an industrial executive should feel a great burden of responsibility for developing all of them as far as is possible, far further, indeed, than all of them will be found to have been developed in any one situation at present. For, in spite of the modern compulsions of trade opinion and pressures to reduce costs which seem very strong, individuals who are responsible for policy frequently seem strangely reluctant to experiment. It is difficult for an outsider to conceive much reason for the attitude of foreign observers who are astonished at our willingness to give up the old and try the new, especially if he tests our practice by anything like ideal standards. What the reasons for this reluctance are we have already discussed as far as we could, not having any dependable data to go on.

In spite of a distrust of too-easy generalization, and of mystical principles which are mistakenly taken for causes, there are several fairly clear practical suggestions which can be made for the future, and a few generalizations or, perhaps it is better to say, hypotheses, which can be adduced, even if some uncertainties and inaccuracies are in all probability involved. This will be done here as simply as seems possible.

The practical suggestions are these:

1. That the rebuilding of industrial units from the ground up seems invariably to achieve such great gains

in efficiency that it is almost always worth while. The arguments against it can infrequently adduce physical results in support. They can sometimes be made in pecuniary terms; but even these are almost always foreshortened, they seldom include a reasonably long run. Usually rebuilding would be found to "pay" eventually, if not at once. More real difficulties exist in the allocation of capital than in any other phase of the preliminary arrangements. This follows from the nature of our investment customs and the domination of allocation functions by irresponsible, stupid, or overconservative bankers who value their own opinions more highly than they do expert analysis, and profit for their own institution more highly than profit to the industries they serve.

2. That the completion of serialization is next in importance to rebuilding. The difficulties in the way here are mostly attributable to lack of imagination. Where there are gaps in serial operation they can almost always be filled if the problems involved are attacked in a serious way by laboratory methods. No real speed or smoothness can be attained until mechanization is complete. With this accomplished there is no logical limit to the stepping-up of the rhythm.

3. That machinery be made to work for us longer and faster than it characteristically does. If this involves cutting down the hours of men involved to six or to four, and the operation of four or six shifts in the day, the increased product would enable us to maintain as high or higher wages. The eight-hour day and the five-day week are enough, or even too much, for any individual to have to work at a job which he does not love. But if hours were cut, say, to four a day, the

choice between any four of the twenty-four and the traditional eight (between eight a. m. and five p. m.) would probably prove favorable to the shorter period. It would seem worth trying.

4. That industrialists move faster than they have in the past toward close association, so that, without compulsion from any governmental controlling body, a general scheme and a definite program, for economic affairs, on a national scale can gradually emerge, with inter-business and inter-industry controlling bodies responsible for coördination and maintaining the smooth flows of goods and services.

5. That the whole field of social, as against voluntary regulation, be studied, so that the controls of society can be applied at the places and at the times which are strategic. We linger in the past, with our clumsy governmental machinery for control hopelessly out of date. We muddle where we ought to clarify; we obstruct where we ought to encourage. Governmental controls ought to be brought to bear where voluntary ones break down, where, in fact, the interests of the public conflict with those of a super-coördinated industry.

6. That workers have most to gain and can contribute most to the industrial process by organization on a more modern and realistic basis than the old craft distinctions. They will gain most in bargaining when their organization coincides with the income-producing group which disburses the gross takings of industry. They will contribute most when they not only try for a greater share of product but when they encourage an increased productivity. This last they will not do unless they have some confidence that their bargaining efforts will be successful. National unionism needs to be preserved

for protecting those interests of workers which are distinct from those of other broad classes; but a re-working of the structure of unionism to bring it into correlation with recent industrial developments would be desirable.

In making these suggestions it has not been intended to enumerate all the processes it would seem desirable to adopt, nor all the items of a program which an economist would like to see industrialists achieve. Rather it has been the intention to center upon those things which, of all others, seem of a key importance which is not generally appreciated. All the suggestions made in the earlier section concerning the causes of productivity seem to furnish items of a necessary whole development. But many of them are going forward, are being put into use as rapidly as could be expected. These just spoken of are not. Often they are not recognized as desirable aims. There is this reason for asking especial notice for them.[1]

2. *Some tentative hypotheses concerning productivity.*

Aside from the practical suggestions which have just been made, it seems reasonable that any study of the

[1] Statesmen and legal theorists, who are developing a new interest in social functions as a desirable basis for statute law, might discover in the study of industrial efficiency a fruitful field for statutory compulsion. It seems no less wicked that an industrial manager should be permitted to pursue an ineffective and wasteful course or practice than that a restaurant-keeper should maintain filthy premises or a railroad charge excessive rates. There is legal recourse to compel efficiency in common carriage; but none to compel it in producing coal. Statutes based on a sound analysis of what is necessary to produce goods in the most effective way would be functional in the strictest and highest sense. The constitutional problems involved are, of course, complicated; but even the Constitution, once legalists are thoroughly convinced, is not immutably opposed to American welfare.

technique which lies behind the rather startling results of modern industry should lead to some reworking of what, in economic theory, are called principles of production. According to orthodox tenet, economic theory recognizes four factors in production: land (which includes all natural resources), labor, capital, and business organization (or management). These are the ingredients of the productive pudding. Combined, with profit as a motive for the mixing, they produce utilities. These utilities are conceived as being apportioned through the pecuniary system as rent, wages, interest, and profits, which are paid in money. These distributive categories depend upon the validity of the categories of production. So our whole system of theory may need revision if production refuses any longer to lend itself to the classifications which our assumptions suppose.

It may not be worth while to reëxamine these classifications to ascertain their acceptability as organizing and containing the data of modern experience. Most industrial engineers do not seem to think it of any importance to do so. But then, engineers see nothing unusual about a 26 per cent increase in production within a few years. To an economist, this seems rather like a miracle, one, also, for which all his study of texts would leave him unprepared. Hence a new attempt at generalization would be, naturally, for him, one of the chief benefits of the fresh analysis of reality. Besides, the attempt to generalize seems valuable because of the relations it discloses among the functions of industry, because of the definition it gives to the larger trends of change, because it attempts to set up verifiable hypotheses, which when tested, form the starting point for new departures in thinking, and because it gives a

representation to the world at large of the results of a particular field of study. But this is not the place for any elaborate defense of theorizing; for theorizing is an incorrigible habit with humans. On this ground, if no other, it may be found excusable.

What is most interesting is to see what would result if there should be eliminated from one's mind what had got into it concerning production from reading the economics texts, and a new beginning were made with the materials disclosed in first-hand discovery of industrial data. What, one might ask, would be the hypotheses which would sort themselves out in one's mind as generalizations to be tested? What seem to be the foci of this movement toward productivity, which are, perhaps, generally true? There are set down here several hypotheses of organized trends in production which seem important, and, at the moment, universal, and which have come largely out of the study of this special technique.

1. That the racial accretion of knowledge and technique is cumulative and that there is a consequent acceleration of the rate of progress. The rate increases in the later stages of the exploitation, through secondary inventions and accommodations, of genuinely basic discoveries. It then slows down until some new basic discovery is made. There may be minor movements within this general rhythm, caused by the varying impacts, upon present practice, of secondary inventions and accommodations.

2. That industrial output is a function of intelligence operating with inherited technique; and that the size of the output is reduced by the amount of frictional resistance furnished by social arrangements. By social

friction is meant the opposition to a normal rate of output by defects in the accommodation of social structure to industry. Industry tends to thrust rapidly through the cultural habits of its time. These are more resistant to change and act as a drag on industry. Everyone knows, for instance, that, with no change in technique or equipment, and without the expenditure of any more energy, we might easily double our output of goods. That we do not is not so much the fault of industry or technicians, as of the lagging social arrangements which fail to accommodate themselves to industry's new possibilities. This difficulty is particularly acute toward the end of an accelerating movement, when industry is moving most rapidly and social arrangements are consequently lagging further behind and dragging harder than at other times. It is such a period of movement, conflict, friction, unrest, which we are in at present. Its difficulties are in turn mitigated by some movements specifically directed toward accommodation, for instance, voluntary associationism and government control.

3. That management, machinery, materials, and forces are the important general factors of production. Management is active intelligence, having custody of a racial store of accumulated knowledges and techniques with the responsibility of producing goods and services by manipulating materials and forces. Machinery is all the designed ways of operating on materials by the application of forces as movers. Materials and forces are, respectively, what is shaped to make goods, and what assistance man can summon to supplement or replace the moving power of his muscles. Materials, so far as the operations of production are concerned,

are extensions of the earth which man inhabits; forces are extensions of his own energy.

A corollary of this is that workers are no longer useful as workers (distinguished from managers and devoted to the function of moving and manipulating) and tend to obstruct rather than to advance productivity. They survive only as inferior machines (because they seem cheaper) and are rapidly being displaced. It is true, however, that many whom we call workers ought to be identified as lesser managers. Even this latter group will gradually be replaced by machinery.

4. That we tend to approach complete mechanization and movement by forces external to man; but that the limits to this movement are set by the incidence of technical changes anywhere in industry which set up radiating waves of change and accommodation throughout its structure. Until production is standardized, permanent, and repetitive in nature, machinization will remain an uncompleted tendency.

5. That production takes place and that we move toward greater productivity, not because of the operation of any single motive in individuals or in social groups, but because of a conjunction of diverse motives in individuals and groups working in and through the complex technical instruments of the productive arts to produce a result which is mainly unforeseen and unwanted, but not necessarily undesirable. Since results are unforeseen they cannot be motives, though they may become so when they are seen. Neither self-interest nor profits are adequate suggestions for motivation. Too many facts are unexplained by their postulation. Nor is the desire to use the product an actuating motive, since so many men produce what they do not use. If

any explanation is needed the attempt at adjustment seems the most universally applicable in production as in consumption. We do the things we do in industry because doing them offers us an adjustment to the external world which, if not perfect, is at least tolerable. Intelligence brought into play in a primary effort toward adjustment is, of course, conditioned by past experience, as it has been organized in the mind, and by the materials which happen to be at hand. These powers of reflection can, in this way, bring action into the service of certain general ideals, an effort in which achievement takes on definite order, unity, and color. Out of them grow ways of acting which, because they are similar in different individuals, become ultimately the institutions of society. Institutions, once formed and visualized, become influences which assist in determining action, usually bending it to their service, so that reforms come mostly from inside and very slowly. This is true of productive technique and it is in these ways that changes come about in productivity.

3. *The conditions of maturity.*

It was implied in our title that industry might be coming-of-age. What was meant was that the physique of industry, so to speak, is developing, that the foundations of maturity are being laid. But, to push the metaphor somewhat further, there will never be any genuine growing-up until the industrial intelligence begins to function in an adult fashion. There are those who feel that the putting away of childish things and the setting to work on the great problems cannot be said to have begun very seriously.

It seems entirely credible, however, that we have been viewing, as we talked about industrial technique, the root-

structure of a mature growth; that it is out of this greatest of our achievements, so far, that further achievement will have to come; and that it is in this way that the barriers erected in the path of advance will have to be removed.

To be concise, there are several conditions of maturity which we need to attain: (1) The need to socialize industry, which means to make it serve social ends rather than individual ones; (2) the need to reconstruct industry so as to take advantage of good incentives rather than bad ones in the interest of a better moral world; (3) the need for such a growth of industry as will give us the material basis of life which will enable us to function at our best efficiency.

In surveying the technique of production have there been mentioned any tendencies which would seem to lead in these directions? This is the question we may finally ask here. It is to be hoped that some progress has been made in centering attention on those developments which actually contribute to efficiency; but it is even more necessary to discover whether, in looking for these causes, any light has beeen thrown on these wider questions.

First, then, is industry becoming socialized? As we move toward greater associationism, toward a generally closer-knit fabric of relations, it seems inevitable that socialization should accompany the movement. The identity of social with group interests grows greater as the group grows larger. An industry run for and by one man with a near-slave group of employees will serve one man's interests only—in so far as he can discover them. As the ownership is diffused, accompanying increase in size, and as owners know less and less about technique, the technicians come to have a greater and greater control. Much has been made of the pos-

sible bad effects of the separation of owners from direct productive responsibility on the grounds that the resulting impersonality is bound to affect adversely the employees, at least, if not consumers. On the other hand, it can be argued that this separation makes possible a domination by engineering minds which never would have been possible under the older scheme of organization. This would seem to be favorable to social ends since engineers will be more interested in smooth operation, always, than in producing profits. On this particular point, Mr. J. M. Keynes may be quoted. He seems to see this particular development in precisely the light of my own observation. And one, at least, who is well aware that Americans steeped in the Veblenian tradition will consider it unorthodox, is frankly glad to have this support:

> One of the most interesting and unnoticed developments of recent decades has been the tendency of big enterprise to socialize itself. A point arrives in the growth of a big institution—particularly a big railway or big public utility enterprise, but also a big bank or a big insurance company—at which the owners of the capital, *i. e.*, the shareholders, are almost entirely dissociated from the management, with the result that the direct personal interest of the latter in the making of great profit becomes quite secondary. When this stage is reached, the general stability and reputation of the institution are more considered by the management than the maximum of profit for the shareholders. The shareholders must be satisfied by conventionally adequate dividends; but once this is secured, the direct interest of the management often consists in avoiding criticism from the public and from the customers of the concern. This is particularly the case if their great size or semi-monopolistic position renders them conspicuous in the public eye and vulnerable to public attack. The extreme instance, perhaps, of this tendency in the case of an institution, theoretically the unrestricted property of private persons, is the Bank of England. It is almost true to say that there is no class of persons in the Kingdom of

whom the Governor of the Bank of England thinks less when he decides on his policy than of his shareholders. Their rights, in excess of their conventional dividend, have already sunk to the neighborhood of zero. But the same thing is partly true of many other big institutions. They are, as time goes on, socializing themselves.[1]

It cannot be denied that a great deal of associationism comes about, not by a natural functional adhesion of groups, but by a forced combination. These combinations are devised by financial promoters often for the purpose of exploitation. The ways of accomplishing this are undoubtedly as numerous as instances are frequent. But, making all possible allowance for this kind of forced combination, there still remains a clear tendency toward associationism of a kind which arises out of normal technical processes. And when this happens, it is always more possible to achieve coördination among producing groups than it was before. This growth of coördination may eventually make a really social system, all the parts of which function in harmony with the rest. At least we can set this as an ideal, remote for the present, but by no means impossible in the future. It is one, too, which may very well grow out of developments which are actually taking place.

It would be a mistake to assume that the people who are at work in industry are motivated by any such ideal. They are not. But it may be, for all that, that it will come about anyway. And that is what is most interesting in the present situation—that is to say, how we can get what we want from what we have got. But it may be possible that tendencies, such as we have discussed, when they have gone far enough, may become suffi-

[1] *Laissez-Faire and Communism*, 1926, p. 61.

ciently defined to become ideals and so to motivate effort. We do not now work for a coördinated national system of operations. When we have worked a little further toward it, however, we may possibly begin to work for it.

Two great drawbacks are evidently our remaining dependence on pecuniary motivation and our faulty notions concerning the functions of social control. It is possible to see how even a pecuniary system may become adapted to the service of social ends provided pecuniary rewards can be identified with genuine productivity, as, conceivably, they might be. But it would seem necessary always to have certain forms of social control, particularly if the pecuniary system is retained. There are two obvious functions which some public body will always have to perform if social results are to be got. One is in the matter of capital dispersal and allocation; the other is that of price control. Probably governmental control at present, always assuming an administration as wise, say, as that of the Interstate Commerce Commission, or as that of the War Industries Board during its brief existence, could perform many more useful functions than these. But they would, perhaps, be of a kind which industry may, by greater associationism, grow to do for itself. These two seem necessarily to be ones which some outside body will have to perform.

The dispersal of capital must be a focus of control for a number of reasons, but most obviously because of the self-allocation which goes on within industries.[1]

[1] Illustrations of this self-allocation are not difficult to find. I quote, for instance, from an article by Robert Denver in the *New York Evening Post* for May 14, 1927, in which the dividend and surplus policy of the National Biscuit Company is discussed:

"It is estimated that the company's business is increasing at the rate of about 9 per cent each year, and has been for some years, in

There is a tendency not to distribute earnings as dividends and to re-collect them by the usual investment

face of ever increasing competition. Plant, machinery, and other facilities necessary in production and distribution of its wares have, naturally, had to be consistently enlarged to take care of this growth. Yet the company has never had to go into the open money market to finance this expansion.

"Quite to the contrary its needs in that direction have been provided for entirely out of earnings. The result is that the equities behind its securities and likewise its earning power have been subject to steady enhancement. Since the capitalization of surplus in 1922, extensive additions to facilities, etc., have been made, yet it is doubtful whether a cursory glance at the balance sheet of the company reveals the full scope of such expansion.

"In spite of the valuable additions to plant, machinery, etc., since that time the value at which these are carried in the balance sheet at the close of 1926, after liberal allowance for depreciation, shows an increase of but $8,000,000 over the 1922 figure. Unquestionably this is far below the real worth of the properties represented.

"Plant and equipment are of the most modern type thus assuring a full measure of economy in operation. The depreciation policy of the company is unusually liberal, thus partially explaining the relatively low value at which its properties are carried on the books. Last year, for example, the first year in which net before depreciation and fixed charges was reported, $1,807,930, or the equivalent of 10 per cent of net earnings after charges, was set aside to cover depreciation.

"The income account of the company, due to the fact that it does not include the record of gross business, can hardly be accepted as depicting the growth of the company as it might otherwise. Still the record of net income and surplus each year after dividends since 1920 is of interest. These figures follow:

	Net Income	Sur. Aft. Dividends
1920	$5,543,120	$1,760,285
1921	5,677,462	1,894,627
1922	11,024,980	6,218,885
1923	12,092,828	4,216,953
1924	12,881,530	2,959,135
1925	13,581,696	3,659,301
1926	14,674,162	1,681,987"

machinery, but to keep them within the organization and use them directly for plant extensions. This is largely responsible for the enormous overequipment of every one of our great industries, a form of waste which would be obviated by some regulation of dispersal and allocation. This right to self-allocation is not an inalienable one and could be reached by a slight extension of the doctrine of public interest—provided the Supreme Court could see that the public interest is harmed by overequipment. Much of our hectic competition in selling arises because of unwarranted plant extension, and prices are kept up because of the costs it imposes. But industries themselves fail to solve the problem because of a certain industry-consciousness which prevents social visualization of needs, and because of our belief that what an industry makes it should dispose of as it sees fit. Only a public body could ever have a wide enough view of national development to hold a steady hand.

Price control is a necessary concomitant of any pecuniary system which may achieve socialization. If there are not price controls there will always be that taking advantage in markets which jeopardizes social needs. One industry may exploit another; one group another group; one individual another individual, with purely fortuitous circumstances furnishing the means, unless some steadying intervention is furnished.[1]

With these two forms of control substituted for the antiquated and obstructive controls which dominate our governmental attitude now,[2] it seems quite pos-

[1] For more on this point see the author's *Economic Basis of Public Interest*, 1922, and J. M. Clark, *The Social Control of Business*, 1926.

[2] *Cf. Anti-Trust Laws, with Amendments, 1890–1923*, compiled by E. A. Lewis, Government Printing Office, 1924.

sible that the rest of a social program may be achieved by the voluntary action of industry of which the beginnings can be divined even now, developing steadily through the productive technique. But it must be most freely admitted that this is a matter which can be only loosely discussed at best. It would be highly imprudent to speak with an air of certainty. It may be said, however, with some confidence, that study of economic realities will yield anyone greater confidence in the future than can ever be got by clinging to orthodoxy or even to the old paradox of economics: that making money does not involve making goods, that in a pecuniary system individuals are set against society, that it pays better to withhold goods and services than it does to furnish them freely. There are forces stirring in these productive activities which may furnish the resolution of this paradox; which may identify individual with social good; which may identify the making of money with the making of goods. It has already been admitted that confidence might justifiably be greater in securing a harmony of interests if there were any discoverable intention in public opinion to support a policy of public supervision of the necessary kind. But here our ideas linger incorrigibly in the past. We persist in the attempt to regulate modern industry by a system designed to manage the old institutions out of which we have emerged as from a chrysalis. And industry escapes any control, in consequence, which amounts to much.

This is the matter in which it is most difficult of all to say what will happen as a result of what is now going on. About the other two questions raised there can be somewhat more definiteness in discerning the conse-

quence of present trends. In the matter of incentives it is often remarked by critics that our pecuniary system inevitably brings out the most antisocial traits in men. We reward them for doing what injures us most. This criticism would be less true in a system in which productivity in goods was correlated with reward, whether in money or otherwise. The modern development of devices to bring wages into definite relations with productivity stresses this. So far as workers are concerned, however, incentives become progressively less important for inducing productivity; as standards are more closely set and as mechanization is more complete work becomes less voluntary. It is difficult to do other than standard work in a highly serialized process. But workers grow less important as workers. Human beings in industry come to be placed more and more in the managerial range. What we call workers are often not this in the old sense at all. The real problem of rewards in the future will be that of pay for contriving ability of greater or lesser sort rather than for any physical acts which may be performed. But when there is less criticism of industry for dissipating its earnings in dividends to vaguely known shareholders, as will happen if the results to be anticipated from closer associationism occur, there will remain only a question of adjusting the claims, within industries, of the several members of the group. This can be done with no more asperity than such a division of gains always incurs. So far as the group is concerned, it will not feel its interests solidly opposed to those of the dividend takers, as is now true. This is, it must be realized, to point to the dissipation of the old conflict between "capital" and "labor" and to say that

the new conflicts will be those between one industrial group and another. But, though on the surface of things this may seem a remote prospect, no one should be surprised to see affairs develop in this direction pretty rapidly. And this may be asserted solely on the evidence of technological realities which seem to be spreading throughout industry. Even here, lacking governmental control at points of conflict (in the markets, largely) it would not be surprising to discover industries setting up national coördinating bodies for the adjustment of these conflicts. Something, a little, of this exists even now.

The main point in this to one who happens to be interested in a better moral world would seem to be that, aside from conflict between individuals within groups to share in a certain budgeted return, there would be a great strengthening of the bonds of identity among men and women engaged in common tasks. They would possess a new ability to regard industrial activity as a service to society rather than to shareholders, who, they now feel, are exploiting them and the public too. This merging of self in the group will come about just as rapidly as the social arrangements we make for industry will let it. And it will serve for the productive morality of which we spoke earlier. But how about consumption morality? How are we to escape from the competitive consumption which involves so much waste and brings out so carefully all the less beautiful exhibitionist traits which are so general a human weakness? Unless technological developments are worthless as evidence of what is about to happen we are entering a period of slow income-leveling, of a gradual reduction in the possible fortuitous gains to be got by

exploiting advantage—which is the way such inequalities come about. Any movement toward greater equality will reduce the tendency there now is to display spending power as a badge of superiority, whether the wealth to support the spending exists or not. If we could definitely get rid of the idea that one is superior who has more income we should not all of us be so driven to displaying our superiority by spending the income in the most showy ways. We might then be free to show our superiority in ways which would contribute to, rather than drain from, the social surplus. But of all this more again.

Even if this leveling of incomes fails to materialize to any extent, there are tendencies which may make us more moral as consumers. The standardization of goods is certainly one, the raising of living levels to the point where most people are able to possess all the usual appurtenances now associated with middle-class existence, is another. This is happening as a result of greater productivity, though we are a good way from it yet. And it restricts the field of ostentation considerably. Also it seems likely that as we grow used to modern goods, they will come to seem to us less objects to be flaunted before unfortunate fellow beings and more the common basis of a good life which is to be achieved not in goods but through them. The diversion of an increasing amount of our surplus to education ought also to have some effect in shaping a better consumption morality.

How about this material basis of life, though, which was the third of the criticisms to be examined in the light of our productive technique? Is our industry likely to furnish this? If our examination of productivity has established anything at all it is that we can

have this material basis at any time we like. That two-thirds of us still live in poverty is a fact. But the responsibility for it lies precisely where we have indicated—in our faulty social arrangements for industry, not in industry itself. And it has been said with sufficient emphasis before that if we could get our social rules out of the way industry would be greatly pleased to double the amounts of goods it turns out within a month. The tragedy of the situation, indeed, is precisely this: that what we could do we are prevented from doing even when we should be happier doing it. But the technicians of industry will solve this difficulty too by applying the same sort of intelligence to coordinating and fitting together businesses and industries which has been so successful in performing these functions for more limited tasks with machines. They will have to get around rule-of-thunb ideas concerning society just as they are having to get around these ideas concerning management. But it seems to be clearly indicated. To prophesy it is only to look for the extension of a definite present trend.

All that which has been said here concerning industrial efficiency and its causes readers will take with a large grain of the proverbial salt. What any one person has to say, of this kind, is not particularly important except as it may be suggestive and engender other thinking about the same subject-matter. This, in the long run, after much discussion and checking over, may come to something. Whether what is now happening in industry will ever yield a genuine science of management, no one knows. There are plenty of prophets, who are conversant with the facts, who do not think so at all. It is perhaps most usual among economists, in

fact, to view modern developments with a very jaundiced eye. Yet we have made some gains, some progress toward science. And about this idea we have permission to use imagination. Indeed no less an authority than the editor of the *Bulletin of the Taylor Society* admits the necessity for a play of imagination in and around the problems of efficiency: "Imagination, speculation, theorizing—call it what you will—is essential to the development of any science. It is essential if industrial society is to discover a science of management. . . . Such speculations may inspire managers to modifications of managerial practice, and it is these modified managerial practices which constitute the objective data on which a superstructure of science is reared."

In this same commentary some further remarks are made which are so pertinent as to deserve quotation:

> However, if imagination is to contribute to the development of a science of management, there are certain conditions to its exercise which must not be disregarded. . . . In the first place, imagination must have a basis of proved fact. It cannot be spun out of vague conjectures. . . . In the second place, if imagination is not to lead us astray, is to play a dependable part in the development of a science of management, there must always be drawn a sharp line between, on the one hand, proved facts and established principles, and on the other hand, "visions in the unexplored background of discoveries." These visions should be presented merely as inspirations to experiment. In the third place, errors of the imagination must be eliminated before they have led us astray, by subjection to "crucial and experimental tests." This is why the physical sciences have developed so much more rapidly than the social sciences—the physical sciences are concerned with data much more easily subjected to crucial experimental tests. This is a major reason why the development of the social sciences is so retarded, and

why the modest beginnings of a science of management which we do have is concerned primarily with the management of equipments and mechanical processing. We have not yet a science of distribution or of human relations in industry. Conduct in industry may be observed, recorded, classified and analyzed as it appears by chance, but it cannot yet be subjected to the manipulation and control required by scientific experimentation. . . .

Even trying to get at the secret of our undoubted advance in efficiency, about which there seems to be little question, is attended with uncertainty. The hardest part of the problem is not to guess, even to guess pretty shrewdly, and with some logical soundness, what the causative forces are, but to prove, ever, that one has succeeded in putting his finger on a cause. It will be seen that there is not the slightest chance of checking imagination by experiment in the genuinely scientific sense. One cannot find an industry in which any single cause is clearly isolated, much less one which is willing to undertake experiment under controlled conditions. All we ever know is that some industries or some businesses are more effective than others. And in these particular ones it is invariably true that more than one possible cause is present. They are of that advanced and experimental type where many desirable changes are studied and many adaptations are made. Faced with this situation I have proceeded to call attention to all the factors which may have played a part, developing some discussion as to the place of each one in the whole. If it has seemed arbitrary, that was not meant; and I should like to repeat that none of it is or could be scientific in a genuine sense. It is as though my readers and myself, being familiar with industrial affairs, had conversed about the situation—except that only

one side of the conversation is here. It is as important as conversation, not more.

Still the belief may be reaffirmed that this is necessary. It is necessary because what we must do socially is to take account of the realities of industry. What is happening must be made the basis of what is to come. We must build our foundations not on the sands of ideality, but on the rock of reality. The social and political structure must fit the industrial scheme, must be, as it were, an extension of industrial technique. This is the way in which we may come to maturity.

CHAPTER VII

GETTING WHAT WE WANT FROM INDUSTRY

1. *The time of decision.*

When a young man comes of age, he traditionally attains a new status in the community. He is admitted to the councils of the elders and a new mantle of responsibility descends upon him. For him, it is a time of pause and casting up before he enters upon the work of his maturity. The stresses and questionings of adolescence have carried him, uncertainly until now, into a world he had no part in making, but from which there is no possibility of escape. In this world he must now find work to do and a way of life which will seem to him good. If his education has been sufficient, if it has, so to speak, placed him as it should, the elements of his problem will be present to his mind. He will know something of his world and of himself and he will proceed more or less wisely to the determination of his rôle in the drama of mankind, a drama which may take a tragic turn, it is true, but which is much less likely to furnish an unhappy ending if his choices at coming-of-age have been made rightly.

It has been the thesis here that industry is coming to maturity, that it has reached the stretches of its career when what has hitherto been haphazard growth, tortured by the uncertainties of adolescence, ought to become a mature career determined by a program of progress, encouraged by a sense of achievement. So

far, this career has had its successes, but also its failures; so that none of us knows certainly for the future whether we shall be present at a cultural tragedy or whether we shall see the newest, and, perhaps, the most lusty youth of the race, come into the full powers of his strength intelligently disciplined for a place in the world, or whether we shall see in him a gradual disorganization and a drift into futility.

Who is it that must make this decision? When we ask this question, of course, our analogy falls to bits. If any one of us had to decide, the matter would be sufficiently complex and the chance of error sufficiently high, but we are committed to decisions which are social—not individual—and this commitment brings with it an increased complexity and a generous liability to error. The conditions of right decision are clearly, under these circumstances, a forthright attitude of decision-making and the data requisite for its completion. The difficulty with most social decisions is that we get no really definitive answers because the alternatives are not plain. It would seem gain at least to escape such confusions as these in planning industry's career.

Nearly all of us are involved, in the sense that we use motor cars, toothbrushes, refined sugar, and glass; we are every day and all day in contact with industrial affairs. Some of us, however, are more directly involved. We work in factories or offices, in mines or forests. We not only use goods but also we help to make them. Especially the world's contrivers must acknowledge responsibility.

As affairs are organized, however, a much greater burden of responsibility is imposed upon industrial executives. They meet it sometimes casually and with

indifference, having in mind what is only of advantage to themselves immediately and in a small way, but sometimes—and all too unusually—meet it prayerfully and with a genuine feeling for its consequence. Among these, even, there is a concentration of responsibility as things are. A bank president who serves on half a dozen directorates obviously accepts a weightier rôle than a plant superintendent. Whether he plays his part with lightness and superficial cleverness may be of momentous importance. It is not an ingénue part. However we are cast in the drama, though, a part of the responsibility for the present ensemble and for the future course of the play is ours, even though it may be a very small one. We ought to realize it more clearly.

There is a rôle for everyone; but not all are equally well acted. One who studies industrial advance must be impressed with successes of certain kinds and failures of certain others. Advances in factory technique, for instance, exhibit the modern intelligence at its best. Advances traceable to general policy formation are infrequent and uncertain.

In general, it must be said that society's part in industry's coming of age seems to be little more than a casual functioning of time. Time goes on; society struggles ineffectually with the discipline of industry. Discipline would involve the multiplication of time by intelligence. We seem to prefer to do other things with our brains; so that there is a distinct lack of maturity in our social sense of order and symmetry. We need an enlightened opinion everywhere among those who are concerned with commerce, even as users of goods. But most of all, of course, we need enlightenment among those who have attained the higher rankings of indus-

try. Critics frequently say at present that, so far, we appear to have got service from business men almost in inverse ratio to responsibility. It must be admitted that there are grounds for this criticism, which is, in itself, as severe a condemnation of our industrial leadership as could very well be made; but also, it might be said with equal truth, the public has done no more than to stand by with complete indifference.

It must never be forgotten that ours is a system which assumes to be motivated by profit, and that we reward productive efforts not according to their productive results but according to their salability. This fact of our system has its consequences in the withholding of effort, for often under the going rules, most is to be gained by withholding and extorting, least by generous expenditure of effort or most effective applications of ability.

This is a circumstance—perhaps most deadly of all—which must be judged to have kept our industrial education backward, for we have consistently as a people turned our backs upon the suggestions for ordering affairs so that the greatest rewards would go to the greatest producers rather than to the shrewdest or luckiest bargainers, to, as the old books used to say, "regraters and forestallers." We are not even yet, most of us, aware of this distinction. And those of us who are aware feel no disposition to do anything about it.

Also it ought not to be forgot, if we are trying to account for social backwardness, that we have developed very gradually from the system of single owner-manager industry which was characteristic of the nineteenth century. This was a system in which the capitalist and the executive of a business were identical and in

which the relations of employer and employee were the simple ones of master and man. There were still kept the personal contact and face-to-face bargaining, which had held over from a still earlier guild system. Ours is a kind of industry in which the separation of capitalist and manager, employer and employee, has practically been completed, and in which impersonal relationships have been substituted for the older ones to which human nature was so much more easily accommodated. The attempts we have made to adjust opinion and policy-making to this fundamental change have been on the whole rather feeble and ineffective. In spite of the completeness of this change we are apt to forget that it has happened when we concern ourselves with industrial policy. The change involved a tremendous concentration of power in the hands of the owners and managers of the various forms of modern business; but there has been a persistent clinging to old theories of relationships in the new and very different age, and this has also had its consequence in confusion; and has helped to prevent the making of a program for the period of industry's maturity.

There must be a reason, however, for the great advances we have made in our ability to raise the levels of living. But, as I have tried to show, these lie in technical advances rather than in any improvements in the making of industrial policy. We could not legitimately expect our technicians, or even our executives, to correct this greatest of our faults. It belongs to that indefinite realm of public policy respecting business which most of us find so dull and so easy to let alone—even those of us who would seem to be in positions where these responsibilities are difficult to evade.

It is surprising how easy "captains" of industry find it to be "captains" rather than "generals." So far as the public is concerned, it is very much easier to enjoy the few, meager (in the light of the possibilities there are) fruits of our youthful industry than to make any active efforts toward enriching the soil which produces the fruit. The motives called for are higher for this further effort, it is true; scarcer, perhaps, also. It is easy to engage the effort to outwit absolute hunger; it is not so easy to go on from a level of life already high to one we can imagine which has about it a touch of splendor; and if we never arrive, that will not be because our technicians have failed us, but because we could not find the resource of spirit in our society which would make their efforts genuinely fruitful.

2. *What we want from industry.*

One who went about asking people what it is they want from industry would receive—if he had the writer's experience—rather inconclusive replies. Many of us seem to live in our complex world as children do. We accept what happens to us, sometimes a little rebelliously, but with a wholly negligent spirit. If we have a plethora of toys, we become extremely careless with them. We complain if prices are high. We are a little querulous about a certain prevailing ugliness in factory districts. We are bitter about the congestion of our cities. We think our particular share of the national income too small. We dislike the growing pressures and monotonies of daily work. But aside from casual complaints, usually of a purely condemnatory and negative nature, we do nothing! We are largely persuaded, indeed, that it is no part of the public's concern what

happens in business. This attitude finds its most characteristic expression in the slogan which reads "Keep the Government out of Business," as though this in itself were not a commitment on the question. As a matter of fact, this amounts to taking a stand, though we may not intend it as more than a gesture in favor of the status quo, or, at most, as an effort to hold gains which we have made in the only way we conceive that to be possible.

This withdrawal, this holding back, is so uncharacteristic of the American spirit in its every expression that it remains a source of puzzlement. Other peoples think of us, and we think of ourselves, as active and adventurous, as experimental and progressive, and yet, in these most critical dilemmas of industrial life, we frequently seem content to sit on the lid of a boiling pot refusing to recognize the heat underneath. The suggestion is sometimes made that if we persist in refusing to use our generating steam, there may be an explosion one day. The means of avoiding such a catastrophe is obviously to experiment with ways of using power, to harness it to whatever purposes we have.

And yet, though many people are indifferent, some are not; and these have been willing to tell what it is they want. In generalized fashion there is written below something of an American consensus. Imagine then that the "typical" American is speaking:

"What I want of industry is that it should make goods—honest goods—and make them cheaply. I want it to sell them cheaply, too, and to arrange its avenues of distribution so that they move smoothly and frictionlessly from where they are made to where I want to find them. This seems no more than we have a certain

right to ask as consumers, and surely it is not too much to ask. Further, and more concretely, I want from industry good and various food; honest and attractive clothing; a sunny, airy place to live, close by my work; I want an automobile which will run smoothly, cheaply and long; a radio; furnishings for my home; materials with which to play the games of which I happen to be fond, and ample space to play them in. And not only for myself do I care about these things. I am, like most other people, fond of my family and care more that they should have these things than that I, myself, should have them. But that introduces other considerations. Living together as we do in a little group, we prefer not to ask others to do our work for us both because it is inevitably expensive and because we do not like "servants"; and so we want all the latest household appliances—electric washers and refrigerators; electric cleaners, gas stoves and the like. We want to get them as fast as they are invented and get them cheaply—but we want more, too. We want parks and playgrounds, for some of us are growing up and need sun and air and exercise; we want clean streets free of dust and filth; and, perhaps most important of all, we want schools in which it will be something of a joy to grow toward the future.

"My family is jointly interested with me in these things and willing as most to do what is necessary to get them. We do not have them all any more than other Americans do, though we are conscious of the great good luck it is to be Americans just now. We should probably not have bathrooms if we lived anywhere else. We should not have telephone service, an automobile, or a radio; we should not have electric cleaners and wash-

ers; we should not, in fact, carry on with anything like our present efficiency and comfort if we happened to have been a French, German, or Russian family.

"But we are conscious, too, that many Americans are not so lucky, and this is disturbing. Somehow we cannot feel it inevitable that these things, which somehow fill in the picture of our lives, should not be available to all other Americans. And we shall never, probably, feel that American industry is doing all that it ought to do until it supplies all Americans as we are supplied.

"Meanwhile, we see that in the midst of good things the first condition of keeping them and of extending their benefits to others is hard work. And so we try to work hard—not that this is unpleasant; indeed it seems to us like fulfillment. Comfort for the sake of comfort is certainly not our idea. So it is that we fail to understand a certain fact about American industry—the withholding of effort or of goods which makes jobs last long and makes goods cost more. We are simple enough to like work, and to want others to have in the greatest possible quantity the things we ourselves can make. We believe, moreover, that in this we are quite ordinary and not at all unusual. We have relations and friends who are engineers, farmers, manufacturers, and plain working men and women. Most of them do not talk about it, but we are confident that they feel just as we do in the matter. And we wish that this common, simple, everyday wish of Americans could somehow make its way into the structure and functioning of our industrial system.

"It is not only as consumers that we have definite attitudes, then, about industrial life, but also as workers.

And in this matter we have equally strong feelings. We want places of work remodeled so that the jobs themselves, which must be carried on, will be intrinsically desirable. There are still whole areas of American work which seem inexcusable. Factories and mills, noisy, dirty, and ill-lighted; machines which drive men at their mechanical pace too fast and overlong: there are too many of these. Some men, and women even, still work at physically exhausting tasks which drag them down nearer, day by day, to the ultimate and inevitable end of such labor. We know, too, that there are many casuals who have been broken and thrown out to rust and rot, and to prey as best they can upon the rest of us until their short lives run out. Worst of all, we know that there are children of whom more fortunate children hear with wide, incredulous eyes, who are forced to work at loom and spindle, and who wither perceptibly under this slow sapping of their youth.

"These things seem to us neither necessary nor willful. We do not recognize in anyone we know the motives which would actively consent to them. We do not want it; and others do not want it. Things bought at such a price are too costly to own. We want to see an industry which will not only move steadily toward better and cheaper goods, but which will make machines to do the work these men and women and children are now doing."

This, pretty much, is the typical American's program for industry. It is simple in that it refers to immediate goods; but it calls for drastic changes, ones which most Americans do not usually visualize. The most searching question which can be asked of indus-

trialists at present is whether this more or less conscious program of Americans can conceivably grow out of the tendencies of our development.

3. *Distorted incentives.*[1]

When anyone attempts to say what Americans want from industry, he must, of course, be conscious that he does not speak for everyone. It cannot be denied that there are people in the world who consider the choice between a little sacrifice for themselves with considerable gain for society, and some gain for themselves with considerable social sacrifice, as simply no choice at all. They have the attitude toward human affairs which smoothed the way a century and a half ago for Adam Smith's self-interest economics. If they think of it at all they doubtless consider that in following closely their own interests they are pursuing the interests of the social group. The horselaugh of Bernard Mandeville over the idea that selfishness in individuals could be the best social policy, and which he epitomized in the phrase "private vices, public benefits," had really very little lasting effect, though it has amused a select few in every generation since. In spite of the undoubted prevalence of self-seeking, it is possible that it persists not because of any perversity in people, but because the world has so changed that motives which once were effective in accomplishing the world's work are so no longer. It is not motives which have changed, but the world in which they operate. Private selfishness can no longer by economic legerdemain be erected into a desirable social policy.

[1] *Cf.* "The Distortion of Economic Incentive," in *International Journal of Ethics*, xxxiv, pp. 272–82 (April, 1924).

It is not a wrong thing but a right one that people should want to provide for themselves and those whom they love. The difference is that the way to provide now is through coöperation, not, as it once was, by exclusively individual effort and by a competitive struggle which wore most of the aspects of war. We still retain the old motives, which are good, but we have developed a means of attaining their ends which is bad. We need, then, somehow, to get our motives to work for us rather than against us.

We are only now beginning to see the relevancy of the curious modern inversion of the psychological stresses of normal living. The desirable ways of living and qualities of behavior observable in less complex economies are here distorted out of all semblance to their origins. In a simpler existence those persons are revered—and thus set the fashion for conduct—who serve their neighbors best, economically and socially. For an illustration of this way of life and mode of conduct we may use the country doctor of a generation or two ago. Others might be chosen, but none perhaps which would be still personally familiar to so many of us. What kind of pay was it that he demanded for his services? Was it money, the power to command wealth? We know that it was not. His pay was mostly in some such sort as a gratefully wrung hand and a later saying in the mouths of people, his neighbors. How would this plain, rough, bearded man appear, fitted out with the trappings of the modern wealthy? Surely the meaning of the contrast between the fundamental motivations of life is plain enough in the mere stating. The fact is that the country-doctor sort of person in the environment which produced him neither could nor

wished to become rich. If there were no other reason, there is explanation enough in the resentment of neighbors. The fact is that, in a simple economy, people see that the getting rich of neighbors is accomplished at the general expense, and they will not tolerate it. There is a remainder of that feeling still so far as some professional classes are concerned, and a faint survival of the notion that great wealth must have been acquired dishonorably.

It may very well be asked why, in the case of the modern rich, we tend to ape their extravagances and at the same time to consider their gains dishonorable, as we undoubtedly do. This feeling of the dishonor attached to wealth may be taken as a survival of the morality of simpler economies which has refused to change as economic conditions permitting such great aggregations of wealth have developed. Competition worked to keep a certain equality in the old system as it does not work now. And we have not come to the point of adopting new controls for leveling incomes although we still retain vestiges of the old morality. This is one of those cases in which we exhibit a confusion of moral ideas. The very wealth we deplore on moral grounds, and the very people we despise for having it are the stimulus for emulation. We want what is undoubtedly dishonorable, but that seems to cause very little diminution in the strength of our desire.

It is therefore to the industrialists and their families that the costly and ostentative luxuries of life most fitly seem to belong. It is clear that the physician who acquires wealth has done so at his neighbor's expense. It is clear that the merchant's or the manufacturer's riches have the same source—in a simple economy. A

shopkeeper from whom only his neighbors buy incurs ill-will along with a fortune. But when society organizes itself a little differently, when it has grown a little, when the area of the market in which the shopkeeper sells grows large enough so that he is socially removed from his customers, he incurs no neighborly disapproval with his wealth. In fact, he appears to be quite a clever fellow, for he is getting rich out of foreigners, and we all of us dislike foreigners anyway. His neighbors, therefore, yield him the praise which is the supreme gratification of man's existence.

In the sense that men are moved by it, all is quite surely vanity. It enlarges and feeds upon itself. He who has had some gratification of this kind is inclined to make the most of it. In order to emphasize his cleverness in business and to obtain more praise, he forces things a little. A bigger house, more servants, and all the other appurtenances of riches convince one's neighbors of the substance. Neighbors are easily impressed, inclined, even, to enlarge evidences of prosperity into the certainty of affluence. The shadow is taken for the substance; the underpart of the pyramid is inferred from the apex. The fellow who can spend most is the cleverest in the neighborhood. The thing becomes a vicious circle, for when he patronizes his friends they are stung into aping him. Can they afford to let their wives and acquaintances think him cleverer than they?

Our social groups are consuming groups, this is the difficulty. We have almost completely divorced our producing lives from our consuming lives. At home and among our friends we have no approval for our productive efforts, and so our neighbors, and, tragically, our very wives and children come to estimate us according to our

incomes, and not only according to our incomes, but according to the evidences we show of power to spend. Income is inferred from expenditures. So it happens that our approvals depend upon the appearance of luxurious surroundings. And for the old morality of service, of workmanship, and of pride in skill, there is substituted the morality of display.

We see that this is due to the nature of the social system, not to any change in human nature which, indeed, is curiously unchanged and helpless in the face of these old stimuli. It drives us, just as it always has, to do the thing which will win for us certain praise. There is a pathetic human weakness for enlargement in the eyes of those we care about; and most of us care most about our family, our neighbors, and our friends. In a simpler economy this human trait made for working standards of responsible living, the service of the group; it tied man to man and knit the community fabric closer. In our modern economy, wide as the possibilities of material success are, it becomes a force which drives us to social sabotage, to spendthrift living, to putting up a front, to being "tin-horn sports," to making shabby goods.

When the cycle of economic processes, production, consumption, and distribution are confined to a group sufficiently small so that the controls of life extend to all the processes and their interrelations, the monstrous luxuries of modernism, so subtle, so perfect, and yet so sterile, are made impossible of happening; but when any part of life becomes depersonalized, as our productive life has, the stresses are twisted and distorted, and human nature, following the lead of old, deep-seated guides and incentives, is led, trusting and helpless, into these cul-de-sacs of degeneracy. There is no chance for any different eventua-

tion. Modes of conduct are not, as we supposed a few years ago, fixed and inflexible. New habit patterns may be constructed which have the force of will in them; but to ask that habit patterns be built up which require an indifference to the approvals of the social group in which one lives would raise other questions quite as vexing. An indifference in one respect involves indifferences in other respects, for instance, and the immense moral force of social pressure is at once lost. Surely this cannot be the answer to the problem that is posed by distortions of economic incentive. We do not want men to be insensitive to group morals. Rather, we want an increased sensitivity.

But if we are to keep men responsive to social approvals, they must yield better fruits than they are now producing. Some moral controls over the immense and increasing spending power of our age must be constructed so that the first recourse of persons who come into money, as we say, will not be to barbaric ostentation and all the silly vanities of competitive consumption. It ought to be wrong to squander wealth, and only right to use it wisely and well. We have got to give up trying to make of every day a Roman holiday; we must sometimes remember to celebrate the appointed feasts of reason.

If the answer to the problem is not to be one which will require a change in human nature so wide and deep as to disturb many other relationships of life, it must involve a change in the stimuli which call out different modes of conduct. It may be that friends, neighbors, wives, and children can be trained to look for productive virtues rather than consumptive spectacles; but this must involve some change from the present in

the direction of making production more spectacular; of setting up measures of productive efficiency; of making it seem virtuous and worthy of approval to be productive. How this can be done in a factory age is, one must admit, very difficult to see, for factories take work out of the home and separate the lives of men and women. In simpler economies, the place of work is the home; production is a joint task; and there are thus built up about it all the associations of home and neighborhood, the setting from which it cannot be extracted. In our age this emotional content with which all things in the home must be charged is removed, and the productive process has to stand by itself without this powerful support, and this has such important results upon the institution of the home also that it, too, seems to move toward disintegration. There is nothing for the home to rest on now that industry has been taken away from it, and there are no more large families to hold things together. Both industry and the home have lost much by their separation; and for neither of these old institutions, as they once existed, or for their place in our lives, is there now any adequate substitute.

Perhaps it can be made to seem wrong to squander wealth; and perhaps it can be made to seem supremely important to produce it. But neither in our popular morality, with its roots in a past age and its controls devised for a medieval economy; in religion, which clings to outworn ethics, irrelevant for the present; nor in public-school education, which is dominated by the two, does there seem to be a sufficient promise. But it is through some such social agencies as these that controls will have to come.

One difficulty which runs all through attempts to get

control of the modern forces in the interest of a better world is that the old rate of change has been superseded by a greatly accelerated one. We have not centuries in modern times to elaborate the detail of one structure as the builders of the cathedrals had. Nor have we centuries in which to work out the moral controls of economic life when the content of life itself shifts so rapidly. But the attempts at mastery will be made; they will be more and more successful, and will in themselves provide for continuing change. This will be so unless the intelligence of man, having brought him so far on a tortuous way, treacherously fails him now.

4. *How can we get what we want?*

If we see what it is that we want from industry in the way of goods and in decent kinds of work, and if we see how it is that our best motives become perverted, we are in a much better position to get what we want than we are if we register only uncertainty when we are confronted with these questions. It is most of all necessary to see that without moral decisions even industrial life cannot be trusted to operate well.

We cannot treat either our morals or our industrial arrangements as absolutes and expect to progress very rapidly. We must at least be willing to let them become accommodated to each other. Which will be required to change most seems unimportant. The real necessity is for fusion. And this fusion can be accomplished only on the basis of expediency. An illustration or two may make this clearer.

After the War we were confronted with a problem of international debt settlements. The kind of arguments used on both sides is in point. Some said we ought

to forgive the debts because it would be a Christian act. Some said we ought to be paid because it was just for a debtor to pay his creditors. A better way to settle the argument was suggested by some hard-headed persons who asked whether it was expedient. The question then arose: "expedient for whom?" And to the surprise of many it was discovered that a nation has little to gain at the expense of other nations, that the world is by now so tied together economically and national boundaries are so irrelevant that what was gain for one was gain for all and what was loss for one was loss for all. But was this clear statement of the matter allowed to prevail?

One who has followed the struggle in recent years for the establishment of the eight-hour day in industry has another similar illustration in a different field. Whether the eight-hour day was expedient seemed to be the last consideration by those who took positions on either side of the argument. One who suggested that it might be right in some situations and wrong in others, depending upon the technical position of the job and upon the kind of work, was considered to be a traitor to one side or the other. But in reality the eight-hour day is not right because it favors workers, nor wrong because it does not favor employers. It is right or wrong because it makes for larger or smaller product, for better or worse working conditions, in a word, because it is or is not expedient in a social sense. And a general position in favor of or against must be judged to be purely idealistic and not practically intelligent.

The recent adoption by the Ford interests of the five-day week raised a whole storm of discussion among

business leaders. Mr. Ford was roundly condemned and his five-day week bitterly objected to by a considerable number of his contemporaries. A sophisticated bystander could guess what arguments would be used. And as would have been expected, they were motivated by a defense of already assumed positions, in their industries, not in Mr. Ford's. Whether it was expedient for Mr. Ford was a consideration which was entirely neglected.

Many similar illustrations from industrial life might be adduced. We are for or against one party to an industrial dispute not because we know the situation and what it requires, but because one settlement conforms to our moral notions and the other does not. We want the coal industry to come under governmental control because we favor governmental control, not because we think it will work well for producing coal; or we do not favor it because we want the government "kept out of business." We favor high or low tariffs, or one form of taxation as against another, with very similar influences shaping the opinion.

It is my belief that we cannot get anywhere in the guidance of industry on an idealistic basis of this sort. But the motives involved are not to be impugned. They are perfectly good human motives. We are trying all the time to be moral conformers. We have only to realize that we cannot get what we want in that way. How this realization can be made general and so change our concrete attitudes toward the making of decisions is not an easy question to answer. Perhaps only the long and slow processes of education will train us to substitute expediency for ideals, the scientific attitude for received dogma, openmindedness for coventional

decisions. I am inclined to that view. But that is perhaps because I am an educator. There may be other ways. But I am perfectly sure of the necessity for escaping from emotional or moralistic attitudes and replacing them by the tests of experience. And this involves the making of decisions rather than accepting traditions.

It might be well to point out, too, that we move within certain rather well-defined limits in getting industry to provide us with goods of the quality and kinds we want. Not to recognize these limits is to become an out-and-out Utopian. For instance, it seems quite clear that we are committed to large-scale organization, to the minute division of tasks, and to the more and more complete machinization of factory work. And it will not do us much good to complain about these things. The time has passed when any choice was possible as to whether we should have them or not and we have to take them as given conditions in working out any program for the future. Just where to draw the line between what can be changed and what we have developed so far as to be irrevocably committed to is difficult to say, often. But there is a difference here which is worth attention. In general, we are apt to err either in thinking that almost anything can be done or in thinking that nothing at all can be done. At this point we are most apt to admit ideals to the picture and go entirely wrong. There are those who hate the industrial system and all its implications. I have philosopher friends who feel that way. They become enamoured, perhaps, of a foreshortened picture of the Greek economy or with the institutions of the Middle Ages—as Mr. Chesterton does—and resolve that every detail of contempo-

rary American life is unworthy a place in their ideal commonwealth. This is unlike the discontent which leads to reform because it seems to result in such an enormity of disgust that any possible change would be too small to be sufficiently effective. As a consequence, most of my philosopher friends spend a great deal of time in those parts of Europe where industrialism may be escaped in favor of the crumbling remains of the civilizations to which their eyes turn backward.

Other people take the opposite view that everything is quite well as it is. America is prosperous; we have the highest living standards ever known to the race; and we show a capacity to increase our productivity which will lead to more of the same thing. President Coolidge's professed attitude is this one. But this overlooks several considerations. The first is that our morals ought not perhaps to do all the accommodating, that is to say, that we do not need to consider everything right which happens to exist. It goes too far in accepting present trends as inevitable and desirable. It overlooks, too, the fact that industrialism is dynamic, that it changes, and that this change, if entirely uncontrolled, will not necessarily be for the better. It also overlooks certain patent disadvantages of the present which no one, I think, would defend unless he were utterly fatuous. There is poverty, there is child labor, there is waste, there is war, there is the terrific grinding monotony of machine-substitution, there is the filth and disorder of our cities; and all of these grow more or less out of the industrial system as we have it.

My own idea is that we might grow away from poverty and the other ugly concomitants of industrialism and toward something better, though not, indeed, like

Athens or Florence or any of Mr. Wells' Utopias. And that we might accomplish this by taking industry as we find it and shaping it reasonably and slowly but also forcefully toward what seem, for the time being, better arrangements. This would be done in great decisions and in small ones, by consumers and producers each in their own way; but it would be better done if we worked to some plan, some expectation by which results could be judged. The first condition of achieving such a plan, however, seems to me, as I have implied, the recognition of present trends so that we may have some assurance that we are working for an attainable result and not wasting effort on Utopian air-castles.

These trends are so important that, unless I am utterly mistaken, they will result in an almost complete remaking of American economic life. In the clear view of them which is emerging all the plans for our future must be made.

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